Charles University

Faculty of Education and Sport

A Case Study of Physiotherapy Treatment of a Patient with Lumbago

Bachelor Thesis

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Abstract

Title:

A Case Study of Physiotherapy Treatment of a Patient with Lumbago

Thesis aim: This thesis concerns the physiotherapy treatment of the diagnosis lumbago. It is divided into a theoretical part and a practical part where the practical part is dominant. The aim of the theoretical part is to describe the anatomical, kinesiological and biomechanics of the lumbar spine and the fragments that mainly influence and works together with it. The practical part is concerned with a woman in the age of in the very acute phase of the first symptoms of lumbago. The aim of this part is to describe the stages of examination, therapy and outcome in relation to the given diagnosis.

Methods: Some of the methods used in the therapy are soft tissue techniques, PNF, breathing, McKenzie, and Dynamic Neuromuscular Facilitation. There were completed in total five therapy sessions.

Result: The patient showed rapid improvements in both pain level and functional disabilities. Her breathing pattern has improved as well as her overall posture. Patient shows good improvement in functional dynamics regarding the back, going from painful and unstable flexion of trunk to more fluent and non-painful movement. Other results show improvements in muscle length of iliopsoas, piriformis and pectoralis major from 1 to 0. There was also less restriction in soft tissues of back.

Conclusion: According to comparative findings in the initial and final examination improvements has been found. She has showed good recovery in short time, even though it is not satisfying result. The patient will have to work on her problem as well as she will continue to come to the physiotherapist at the clinic Monada. Her overall prognosis is good if she will continue to exercise.

Keywords:

Lumbago, nonspecific low back pain, treatment, physiotherapy

Declaration

I hereby declare that this work is entirely my own, individual work based on knowledge gained from books, journals, reports and by attending lectures and seminars at FTVS.

I also declare that no invasive methods were used during the practical approach and that the patient was fully aware of the procedures at any given time.

Prague, March 2014

Acknowledgements

As I tend to be a bit traditional and since I have my family very close to my heart, I first and foremost would like to thank my Dad, Nymo, Hans my Mom Falch, Tone and my three brothers, Nymo Falch, Magnus, Jonas and Fredrik for their love and support. I must also thank my boyfriend Falkmo, Stefan who encourage and inspire me every day. There has been three years with highs and lows during my studying abroad and they have all supported me on every part of the way. No matter of successful times or not, their love and support have not changed. I wish them all good in life.

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To conclude, thank you again to all, listed or not listed here, for the help, which finally made me finish my Bc. work. My journey is far from over.

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List of Contents

1 Introduction

This thesis concerns a theoretical and practical aspect of the diagnosis lumbago. Lumbago is defined, as a non-specific low back pain where the exact cause of pain is not clear. In most cases it is not due to a serious disease or other underlying cause, but rather a reason to mechanical and muscular strains.

This thesis is divided into two parts – one general and one specific part. In the general part the theoretical knowledge of lumbago or nonspecific low back pain is described. The whole human body and vertebral column is considered in relation to the lumbar spine deliberating the topics of anatomy, kinesiology and biomechanics. This is followed by the description of the specific disease in order of characterization, clinical picture, therapeutically approaches, and prognosis.

The special part of the thesis is a case study of a patient with acute lumbago. It discusses the examination and therapy progress of the patient in a period of two weeks at the private clinic Monada, in Prague. In this study the aim has been to assess whether functional abnormalities has been reversible and if it has been reliant on the treatment outcome. Before versus after examination has been highlighted to score the effectiveness of the therapy.

The thesis is equipped with a list of literature, figures, tables and explanations of abbreviations that can be found in the supplement.

2 General Part

2.1 Anatomy and Kinesiology of the Spine

2.1.1 Anatomy

Overview

There are 33 individual bones called vertebrae that interlock with each other to form the spinal column. The vertebra are numbered and divided into regions: cervical, thoracic part, lumbar, sacrum and the coccyx. Only the top 24 bones are movable; the vertebra of the sacrum and coccyx are fused. (1)

Vertebral joints

The mobility of the vertebral column is provided by the symphyseal joints between the vertebral bodies, formed by a layer of hyaline cartilage on each vertebral body and the intervertebral disc between the layers.
The synovial joints between the superior and inferior articular processes on adjacent vertebrae are termed the facet joints. They permit simple gliding movements. (1)

Vertebral ligaments

The ligaments of the spinal column bind the vertebrae securely to one another and enable the spine to withstand high mechanical loads and shearing stresses. The ligaments are subdivided into vertebral *body* ligaments and vertebral *arch* ligaments. (1)

Vertebral body ligaments

The anterior longitudinal ligament (ALL) and the posterior longitudinal ligament (PLL) run the entire length of the spinal column. The ALL attaches to the front of the vertebral bodies and the PLL to the back. (1)

Vertebral arch ligaments

The ligamentum flavum passes between the laminae of adjacent vertebrae. They are thin and broad and consist of elastic tissue, which is stretched during spinal flexion, and shortened during extension. When the spinal column is erect, the ligamentum flavum are under tension and help the back muscles to stabilize the spine in the sagittal plane. They also act as checkreins to limit forward flexion of the spinal colomn, thereby helping to maintain the position of the flexed spine. (1)

Other arch ligaments of the spine are: Ligg. supraspinale, Ligg. interspinalia, Ligg. nuchae and Ligg. intertransversia. Their function is to stabilize the spine. The supraspinous ligaments attaches to the spinous processes along the spine. This ligament is bigger in the cervical region and there it is called the nuchlae ligament. (15)

Intervertebral discs

Each vertebra in the spine is separated and cushioned by an intervertebral disc, keeping the bones from rubbing together thus also linking them together. They are fibrocarilaginous pads serving as the spine´s shock absorber and occupy one-third of its height. (38) Their major role is mechanical, as they constantly transmit loads arising from body weight and muscle activity through the spinal cord. Each disc permits slight flexion, extension, lateral flexion, rotation and some circumduction. (15)

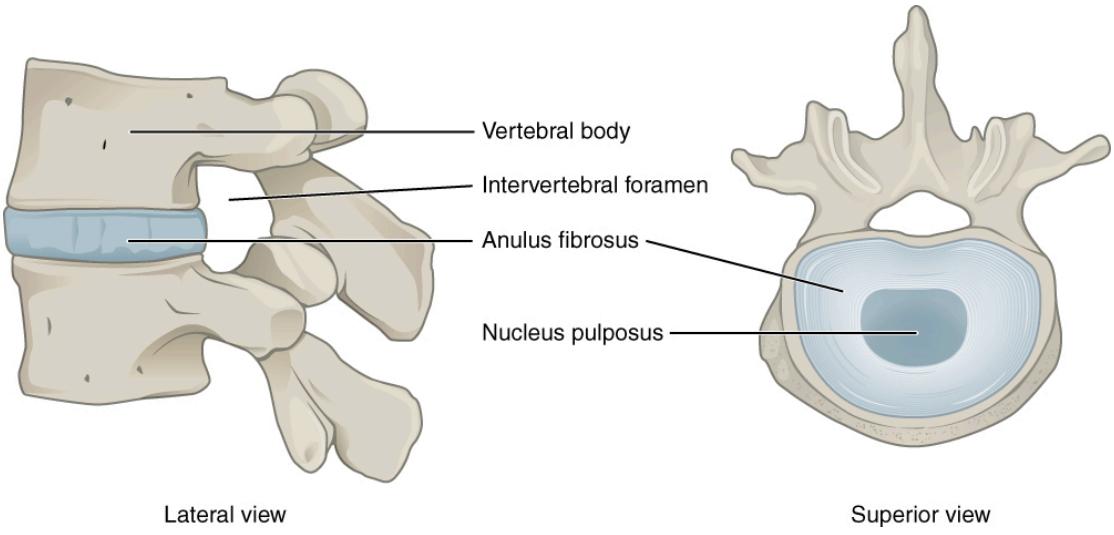

Figure 1 Intervertebral disk: Lateral and superior view

The intervertebral discs are complex structures that consist of a thick outer ring of fibrous cartilage termed the annulus fibrous, which surrounds a more gelatinous core known as the nucleus pulpous. (2)

Trunk muscles

Muscles of the back are organized into superficial, intermediate and deep groups. In this section I will enumerate muscles of the deep group of the back and the muscles of the abdominal wall. The deep muscles of the back extend from pelvis to the skull, and are innervated by posterior rami of spinal nerves and are directly related to movements of the vertebral column and head. They all include (36):

- Deep posterior muscles

  → **The erector spinae** and **transversospinales**

  - The erector spinae divides in the upper lumbar region into three vertical columns of muscle, each of which is subdivided regionally, depending on where the muscles attach; **iliocostalis, longissiumus, and spinalis**
  - The transversospinales consist of three major subgroups; **semispinalis, multifidus and rotatores**

  - **ACTION:** Extension and rotation of the vertebral column when sacrum is fixed

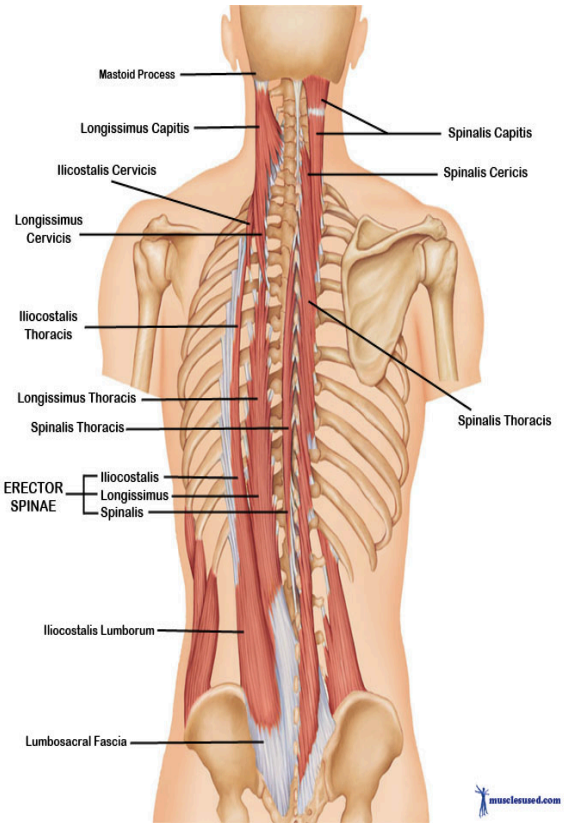

Figure 2 Deep muscles of the posterior trunk

- Deep lateral muscles
    - → **Quadratus lumborum** and the **psoas**

    - **ACTION:**
        - **Quadratus lumborum:** Flexes the trunk ipsilaterally, with help from int. and ext. oblique
        - **Psoas:** Lateral rotation ipsilaterally and rotation contralaterally. Flexes the femur bilaterally

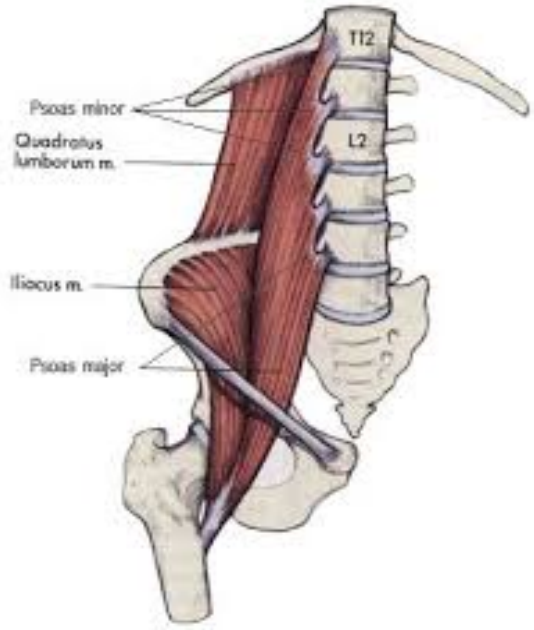

Figure 3 Deep lateral muscles of trunk (2)

- The short segmental muscles;

    → The **levator costarum, interspinales and intertransversarii**

- The muscles of the abdominal wall
    - **Rectus abdominis, Transversus abdominis, Internal oblique abdominis, External oblique abdominis**

    - **ACTION:** Powerful flexors and rotators of the trunk

Anatomical details of the lumbar spine

The lumbar spine is made up of five vertebras, L1 to L5. In a normal spine they are aligned straight in the coronal plane. When viewed in the sagittal plane, the normal adult lumbar spine has a lordotic curve. Normal lumbar lordosis is 30-50 degrees. (15)

The distal end of the lumbar spine is linked to the pelvis through the lumbosacral joint. Massive ligaments running from the processes L4-5 to the iliac crest and the sacral bone hang it together. (36)

Lumbo-sacral joint

The last two lumbar vertebrae are joined directly to the iliac bone by the superior and inferior iliolumbar ligaments. (36)

Nerves of the dorsal and ventral branches of lumbar spine

The nerves innervated in the area of the lumbar spine are divided into dorsal and ventral branches. The L1-4 dorsal rami tend to form three branches, medial, lateral, and intermediate, which are distributed, respectively to the facet joints and the muscles and skin of the back, primary the multifidus, iliocstalis and, longissimus. (9) The ventral branch of L1-4 forms the lumbar plexus which courses laterally and inferiorly to enter the body of the psoas muscle, with the last thoracic nerve, T12, usually supplementing the first lumbar level by a twig.

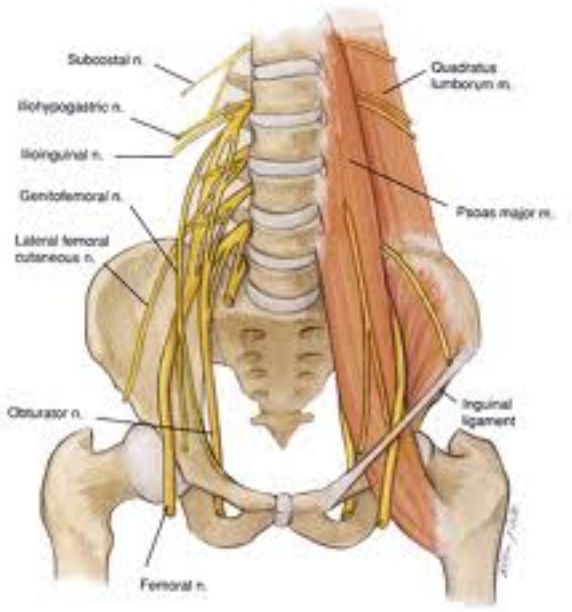

Figure 4 The lumbar plexus lies in the psoas compartment

Nerve	**Segment**	**Innervated muscles**	**Cutaneous branches**
Iliohypogastric	T12-L1	• Transversus abdominis • Abdominal internal oblique	Anterior and lateral cutaneous ramus
Ilioinguinal	L1		Anterior scrotal nerves in males Anterior labal nerves in females
Genitofemoral	L1, L2	Cremaster in males	Femoral and genial ramus
Obturator	L2-L4	• Obturator externus • Adductor longus • Adductor brevis • Gracilis • Pectineus • Adductor magnus	Cutaneous ramus

Femoral	L2-L4	• Iliopsoas • Pectineus • Sartorius • Quadriceps femoris	Anterior cutaneous branches Saphenous
Short, direct muscular branches	T12-L4	• Psoas major • Quadratus lumborum • Lumbar intertransverse	

Table 1 Nerves of the lumbar plexus

2.1.2 Kinesiology

Structural and movement characteristics of spine and lumbar vertebrae

The lumbar spine absorbs the majority of our body weigh plus any weight that we carry. The lumbar vertebrae has increased surface area compared to the other vertebraes, and this special structure together with the facet and IVD joints allows it to bear 80% of the weight passing through the spine. (30)(36)

Movements of the lumbar region are large in flexion and extension ranging different grades in various levels of the vertebrae. Movements include flexion 60 °, extension 35 °, lateral flexion 20 ° and rotation 5 °. (13) Movements in a *specific* region of the spine depend on the shape of the joint surfaces. Most movement of the lumbar spine occurs between L4 and L5 and between L5 and S1; most disc herniations occur at these two levels. (3)

The main structures that allow the mentioned motions are the **muscles** and the **ligaments** attached to the lumbar spine. In the X.X Anatomy section of this thesis, more detailed description of all the specific muscles, ligaments and nerves and their actions/restrictions are described. In this section I will give a brief overview of the muscles and their actions in a kinesiology point of view, but focus mainly on the stabilizing elements that are important in the diagnosis of low back pain.

Muscles and ligaments

The erector spinae and the deep posterior muscles running in pairs along the spinal column provide the extension movement of the trunk. The extensors also are very active, controlling flexion of the trunk through the first 50-60 degrees of a lowering action with gravity. The abdominals produce flexion of the trunk against gravity or resistance. They also produce rotation and lateral flexion of the trunk with assistance from the extensors. (13)

The ligaments are intermeshed with fascia, tendon attachment and outer portion of IVD and function to provide restraint of motion. (18)

Combined movements of the pelvis and trunk

There is a mechanical relationship between the movement of the pelvis and the trunk. They have to synchronize to make fluent movements and this is referred to as the *lumbopelvic rhythm.* In trunk flexion, the pelvis tilts anteriorly and moves backward. In trunk extension, the pelvis moves posteriorly and shifts forward. The pelvis moves with the trunk in rotation and lateral flexion. (13)
Blocked movements in the sacroiliac joint causes the distortion of pelvis bone and causes the reciprocal shift. This distortion causes problems in the axial organ because of compensatory shifting of the pelvis which again and can lead to pain. (36)

Posture and Spinal Stability

Muscles that play an important role in spinal stabilization include the transversus abdominis, multifidus, erector spinae, and internal oblique. The transverse abdominis circles the trunk like a belt and together with the diaphragm and pelvis floor regulate abdominal pressure and spinal stiffening. (18,22) Efficacy of motion and stress imposed on the spine are very much determined by the posture maintained in the trunk as well as trunk stability. In the sections below I will describe the important factors influencing the positioning of the vertebral segments. (30)

Standing posture:

To maintain an upright posture in standing, the S-shaped spine acts as an elastic rod in supporting the weight. As described in section of Biomechanics, a continues forward bending is imposed on the trunk due to the center of gravity lying in front of the spine. This results in posterior muscles having to work to control and maintain the standing posture. Disruptions of the upright posture due to slouched or swaying position is will lead to the spine “hanging” on the ligaments and capsules. This is controlled and brought back into alignment by the erector spinae, abdominals, and iliopsoas muscles. (22,36)

Sitting posture:

Sitting position places increased load on the lumbar spine compared to standing, because it creates a backward tilt, a flattening of low back, and a corresponding backward shift of center of gravity. When sitting for a prolonged time the flexed

position will increase the resting length of the erector spinae and overstretch the posterior ligaments. (22) This state causes nociception succeded by lower back pain. (36)

Iliopsoas and connection to lumbar stability

Vladimir Janda (16) and others categorize iliopsoas as a "postural" muscle, which makes it prone to contracture and shortening. The iliopsoas muscle plays a primary role in determining postural faults and may have a profound effect in the stresses placed in the lumbar spine. Although many muscles are responsible for determining equilibrium of the lumbar spine and body, the iliopsoas has multiple functions (17):

- Maintain lumbar lordosis
- Maintain correct anteversion of the pelvis
- Bilaterally responsible for flexion movements of the spine and hip joint
- Provide lateral stabilization of the spine

Importance of the thoracolumbar fascia

Another important support structure in the region is the thoracolumbar fascia (TLF), which runs from the sacrum and iliac crest up to the thoracic cage. It is a dense connective tissue with a well-developed lattice of collagen fibers. This fascia offers resistance and support in full flexion of the trunk. The elastic tension in this fascia also assists with initiating trunk extension. (13)

The thoracolumbar fascia has three layers attaching to many other core stabilizing structures of the central zone (21):

- *Anterior layer* – Attached from the anterior aspect of the lumbar transverse processes and the anterior surface of the quadratus lumborum.
- *Middle layer* – Attaching to the medial tip of the transverse processes, giving rise to the transverse abdominis.
- *Posterior layer* – Covering all of the muscles from the lumbosacral region through the thoracic region, and all the way up to the cervical splenii attachments.

Another important factum is that the internal fibers of the TLF also attach to the posterior fibers of the internal obliques and diaphragm, thus playing a role in establishing core stabilization via its contribution to intra abdominal pressure (IAP). (20)

The combined spinal stabilizing system

The combined spinal stabilizing system is comprised of balanced co-activation between the deep cervical flexors and spinal extensors in the cervical spine and upper thoracic region, all sections of the abdominal and spinal extensors in the lower thoracic and lumbar region as described above. Together they work with important subdivisions of the core like the diaphragm, pelvic floor, and intra-abdominal pressure to produce maximum stability in the abdominal and lumbar back region. (22)

Diaphragm and postural function of breathing

The role of the diaphragm is essential for both *respiration* and *spinal stability* and all resultant movements. During early postural development, the diaphragm function primarily as a respiratory muscle. With continued CNS maturation and development to about 4½ months of age, sagittal stabilization of the spine, pelvis, and chest is fully established for subsequent movements that occur in the transverse plane, (e.g rolling, turning, creeping, crawling) and eventually the transition to upright posture. (22)

The diaphragm begins to fulfill its dual function as both a respiratory and postural muscle when abdominal breathing is coordinated with chest breathing at about 6 months of age. (22) In this stage the spine is kept upright by the help of the breathing movement itself. The breathing changes the shape of the thorax and also therefor the posture by continuously influencing the spinal curves. The diaphragm moves down during inspiration and leads to extension, while moving u during expiration leading to flexion. Expiration is accompanied by isometric activity of abdominals pushing the belly inwards and the diaphragm upwards to support the process of expiration itself. If however, the spine is rounded due to slumped posture, and transient flexion position during expiration the deep stabilization system will shut off and increase overloading of the spinal segments. (24)(36)

Kolar et al. did a study observing that if there is malfunctions in the postural activation of the diaphragm when isometric resistance is applied to the spine and lower extremities, such as in heavy lifts and external loads, it might serve as an underlying mechanism of low back pain due to great strain on the ventral region of the spinal column. This is due to compensatory activity of the superficial spinal extensors, and abnormal position of the chest or ribcage due to an imbalance between upper and lower chest musculature shown on Figure 5(18)

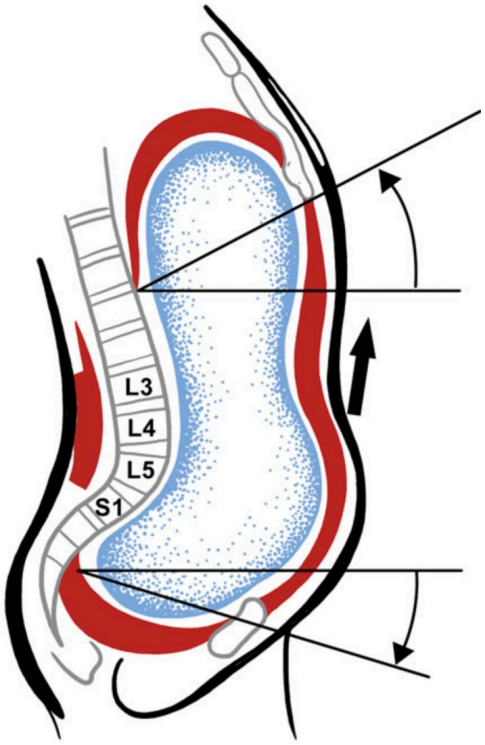

Figure 5 Impaired spinal stabilizing system shear stresses on lumbar segments (22)

There is a narrow relation between the diaphragm, axial organ and abdominal muscles. The abdominal muscles and the diaphragm work as partners, and not as antagonists, in both phases of respiration. This balance is important for keeping the upright posture. If abdominal muscles are slackened and flaccid, the abdominal wall protrudes forward. However, if they have a good muscle tone, the protruding will not happen, diaphragm is well fixated, and they will work as good stabilizers to the whole axial organ. (36)

Pelvic floor

The pelvic floor is a hammock of muscles that connect the pubis bone at the front to the coccyx and ishial tuberosities at the back. It consists of the muscles levator ani and coccygeus. The pelvic floor supports the bladder and the reproductive organs and connects the inferior aspect of the hipbones and the sacrum. The tension in these muscles must be balanced because they play a major role in both proper function of the bladder and uterus, but also cooperates with the posterior back muscles, abdominals and abdominal diaphragm for respiration and stabilization of the lumbar spine and SI joints. (25)

When the spine is challenged in a predictable manner, such as when a limb is moved rapidly, the pelvic floor muscles, transversus abdominis and diaphragm contract in advance of initiation of the movement. (22) It is therefor necessary that the muscles that surround the abdominal cavity are coordinated to meet the demands of control of the lumbar spine. Changes in recruitment of the pelvic floor muscles often results in over - and under activation of particular muscles and muscle groups, which over time can lead to muscular imbalance. (25)

The role of intra-abdominal pressure

The intra-abdominal pressure plays a role in relieving pressure in trunk motion and heavy loads. The reason for this is that the pressure acts in all directions, both on the pelvic floor as well as on the diaphragm. Correct inspiration pattern should begin in the abdominal part, continue to the middle part and end in the upper part. Inspiration is an active process, which increases the abdominal pressure by pushing air, caudally/cranially, laterally as well as ventrally/dorsally. When for example a subject is lifting an object the pressure generates a moment opposite, which means that the force of the extensors of the back and the load on the spine ought to be reduced. (36)

2.2 Biomechanics of the Lumbar Spine

Forces acting on the spine include body weight, tension in the spinal ligaments, and tension in the surrounding muscles, intraabdominal pressure, and applied external loads. (5)

During erect standing, the total-body center of gravity is anterior to the spinal column, placing the spine under a constant forward-bending moment. To maintain body position, this torque must be counteracted by tension in the back extensor muscles. Because the spinal muscles have extremely small moment arms with respect to the vertebral joints, they must generate large forces to counteract the torques being produced about the spine by the weights of the body segments and external loads. Consequently, the major force acting on the spine is usually derived from muscle activity. (4)

In comparison to the load present during upright standing, compression to the lumbar spine increased with sitting, increases more with spinal flexion, and increases still further with a slouched sitting position (*See figure 6)*. During sitting the pelvis rotates backwards and the normal lumbare lordosis thend to flatten, resulting in increased loading on the intervertebral discs. (5)

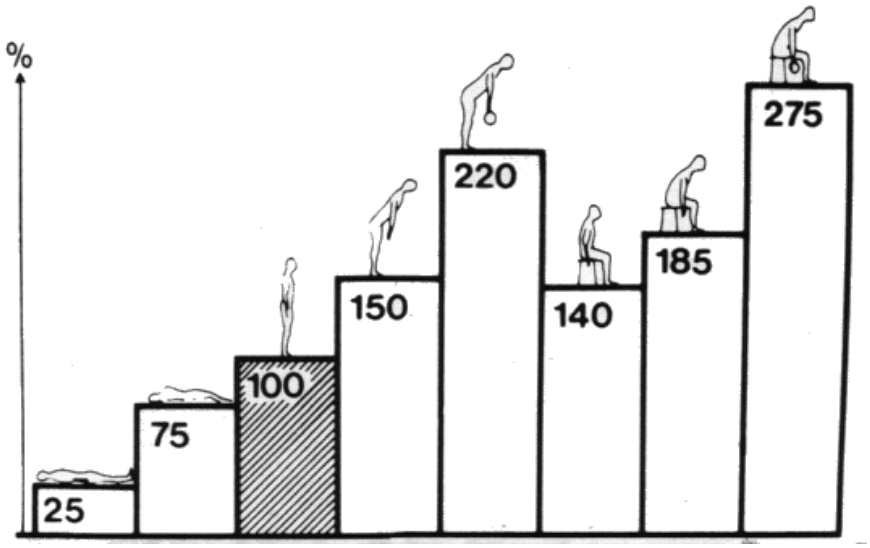

Figure 6 In vivo loads on the lumbar spine (37)

During erect standing, body weight also loads the spine in shear. This is particularly true to the lumbar spine, where shear creates a tendency for vertebra to displace anteriorly with respect to the adjacent inferior vertebra, which again creates tension in the paraspinal muscles. (4)

2.3 Disease

2.3.1 Characterization

Low back pain is referred to pain in the lower part of the back. It can be defined as mild to severe pain or discomfort in the area of the lower back. The description of the symptoms may range from tenderness at a particular point to diffuse pain. It may or may not worsen with certain movements, such as raising a leg, or positions such as sitting or standing. Either way, the fatigue sets in, usually in form of trigger points with attachment pain points, and this increases to become pain during postural and/or dynamic loading. Often the symptoms are more the result of postural strain than of movement. (30)

Cause

There are different factors that can foster the pain; movements that involve lifting, twisting or forward-bending can be the cause and start the symptoms either right away or upon waking up the following morning. More frequently, however, pain is the result of poor posture and excessive static strain. () It can be caused by exclusive static position for prolonged time or by faulty movement patterns. The pain can therefor also develop gradually by factors that put excessive stress and strain to the locomotor system structures.

The pain can be classified by duration as acute or chronic; Acute low back pain is low back pain present for up to six weeks. The *early acute phase* is defined as less than two weeks and the *late acute phase* is defined as two to six weeks, secondary to the potential for delayed-recovery or risk phases for the development of chronic low back pain. Low back pain can occur on a recurring basis. If there has been completely recovery between episodes, it is considered acute recurrent. (8)
Chronic low back pain is pain lasting for more than 12 weeks in duration. Chronic low back pain is frequently experienced as chronic symptoms that are significant enough to impact function or quality of life. (8)

2.3.2 Clinical picture

In the clinical picture of low back pain there can be found various clinical states or combination of states according to severity of cause. The priority in the examination procedure follows this line of clinical reasoning. The first priority is to make sure that the problem is of musculoskeletal origin and to rule out non-spinal pathology. The next priority is to decide whether the patient has nerve root pain. The patient's pain distribution and pattern will indicate that, and the clinical examination will often support it. In case of first and second clinical picture it might happen that the patient suffers from conditions like arthritis of joints, slipped disc, collapse or fracture of one or more vertebrae, deformation of natural spine curvature, skeletal damage due to tumor or infection. If that is not the case, the pain is classified as non-specific low back pain/lumbago. (7)

Clinical signs

In the specific clinical presentation of the diagnosis lumbago there is no obvious precipitant that can be found. The most essential finding is:

- Postural asymmetry
- Weakness of the abdominal and gluteal musculature (14)
- Hyperactivity of the hip flexors and erector spinae (14)
- Great pain that is centralized in the lower back with stiffness occurring in a longer period of time.
- Patient is often and most commonly hypermobile
- Insufficiency of the deep stabilizer system (very common), which is linked with the compensatory development of large numbers of trigger points
    - Principally in the long muscles (e.g. erector spinae, quadratus lumborum, or rectus abdominis). (14)
- Normal neurological exam and negative straight leg test.
    - Although the patient can present with some form of radiating pain, either in buttocks or the leg, and there is no sign of the nerve root being affected, most likely lumbago is present and there is probably "diffuse pain".

2.3.3 Epidemiology

The prevalence of low back pain in the adult population varies with age. The likehood that an individual will recall on survey that they have experienced back pain in their lifetime reaches 80% by the age of 60 years. In the industrialized societies, low back pain is expensive costing an estimated 15 to 50 billion per year in the US. Specific causes for most LBP are not known but the significant portion of the problem is of mechanical origin. It is often referred to as clinical spinal instability. (6)

2.4 Common structural pathology

During consultation with patients with acute low back pain a thorough history taking and brief clinical examination is important and often sufficient to find exact cause of the pain. The primary purpose of the initial examination is to attempt to identify any "red flags" and to make a specific diagnosis. It is, however, well accepted that in most cases of acute low back pain it is not possible to arrive at a diagnosis based on detectable pathological changes. A simple and practical classification, which has gained international acceptance, is by dividing acute low back pain into three categories – the so-called `diagnostic triangle`(7):

- Serious spinal pathology
- Nerve root pain / radicular pain
- Non-specific low back pain

In the clinic there are many various structural conditions that can be found with a patient presented with low back pain, but in this section I will describe the most common ones, which is often seen in the medical professions.

2.4.1 Spinal pathology

Scoliosis

Scoliosis is a three-dimensional deformity of the spine. In its most common form, idiopathic scoliosis (70% to 80% of cases), the cause is unknown. Scoliosis is defined as a curve of at least 10 degrees, measured on standing radiograph. At the end of a child´s growth, the risk of health and social problems in adulthood increases significantly. Problems include reduced quality of life, disability, pain, increased cosmetic deformity, functional limitations, sometimes pulmonary problems, and progression during adulthood. Because of this, management of scoliosis is very important to prevent secondary problems associated with the deformity. (34)

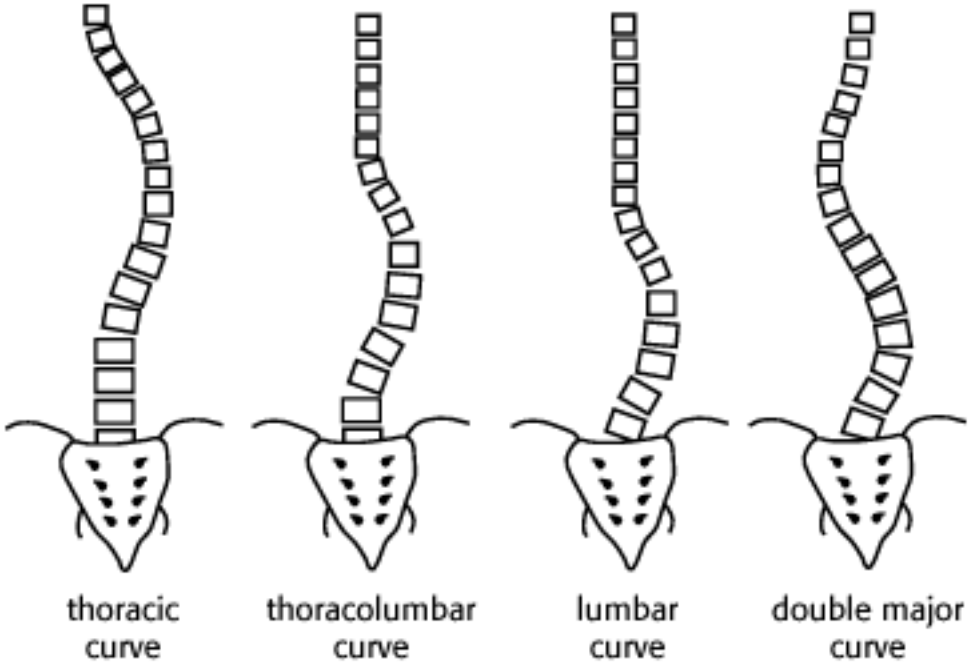

Figure 7 Patterns of scoliosis (34)

Treatment

Almost 10% of those diagnosed with scoliosis will require some form of treatment. The level of evidence in the conservative management is broadly discussed, whatever treatment is always considered. Treatments applied in this field include surgery (fusion), bracing and/or exercises depending on the grade of the scoliosis. Usual generalized physiotherapy consists of low-impact stretching activities like yoga, pilates or tai chi, but can also include many different exercise protocols according to the preferences of both the patient and therapist. (35)

Spondylolysis and Spondylolisthesis

Spondylolysis and spondylolisthesis are a common cause of structural back pain. The term "spondylolysis" refers to dissolution of, or a defect in, the pars interarticularis of a vertebra. The term "spondylolisthesis" refers to slipping, or olisthesis, of a vertebra relative to an adjacent vertebra. Slippage or spondylolisthesis occur in about 30% of patients with spondylolysis. The slippage is much more frequent in individuals with bilateral spondylolysis and those with mechanical instability. There are five types of spondylolisthesis: dysplastic, isthmic, degenerative, traumatic, and pathologic.

In adult patient´s presented with low back pain there is commonly due to the degenerative spondylolisthesis. It is secondary to osteoarthritis leading to facet incompetence and disc degeneration. This condition allows anterior translation of one vertebra to another. (29)(39)

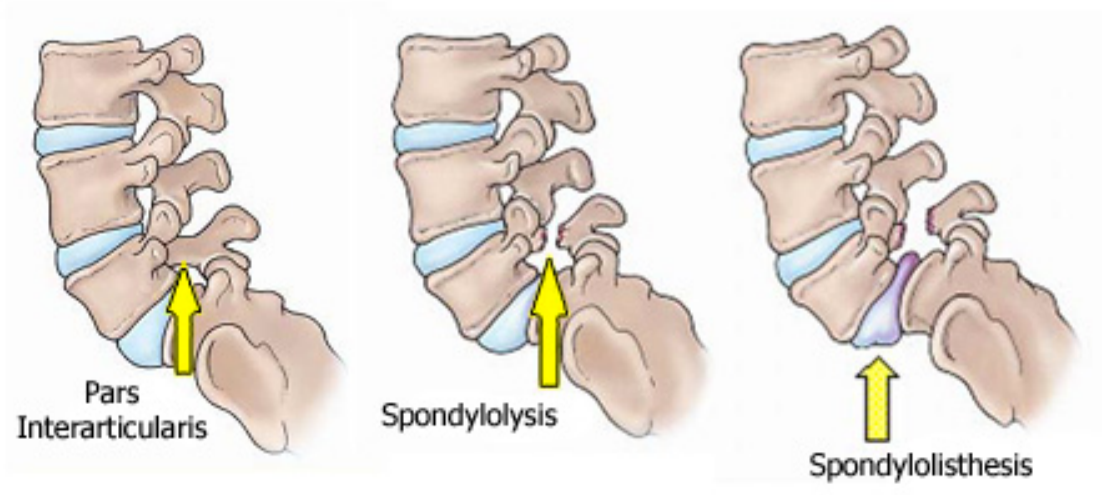

Figure 8 Fractures of pars interticularis can lead to spondylolysis and spondylolisthesis (29)

Treatment:

The treatment for spondylolysis and spondylolisthesis is initially conservative and aims to reduce pain and facilitate healing. Conservative treatments for acute spondylolysis include activity modification (resting from sports participation), bracing, and physical therapy to improve flexibility and strength. Non-surgical conservative treatments successfully relieve pain in approximately 80-85% of patients with acute spondylolysis. (29)

2.4.2 Herniation and radicular pain

Disc herniation

The majority of spinal disc herniation cases occur in the lumbar region, followed by the cervical region as the second most common. In the lumbar spine the herniation tends most often to occur between L4-L5 and L5-S1.

The intervertebral disc is composed of an outer fibrous part that surrounds a central gelatinous mass. There are many structures surrounding the intervertebral discs: vertebral bodies, the spinal canal, anterior longitudinal ligament, posterior

longitudinal ligament, nerve roots, nerves and muscles among others. A discus herniation can cause mechanical irritation of these structures, which in turn can cause pain. This is presented as low back pain with possible radiculopathy if a nerve is affected (26).

There are four types of herniated discs described in the Clinical Anatomy and Management of Back Pain (27):

1. Bulging – Extension of the disc margin beyond the margins of the adjacent vertebral endplates
2. Protrusion – The posterior longitudinal ligament remains intact but the nucleus pulpous impinges of the annulus fibrosus
3. Extrusion – The nuclear material emerges through the annular fibers but the PLL remains intact
4. Sequestration – The nuclear material emerges through the annular fibers and the PLL is disrupted. A portion of the nucleus pulpousus had protruded into the epidural space

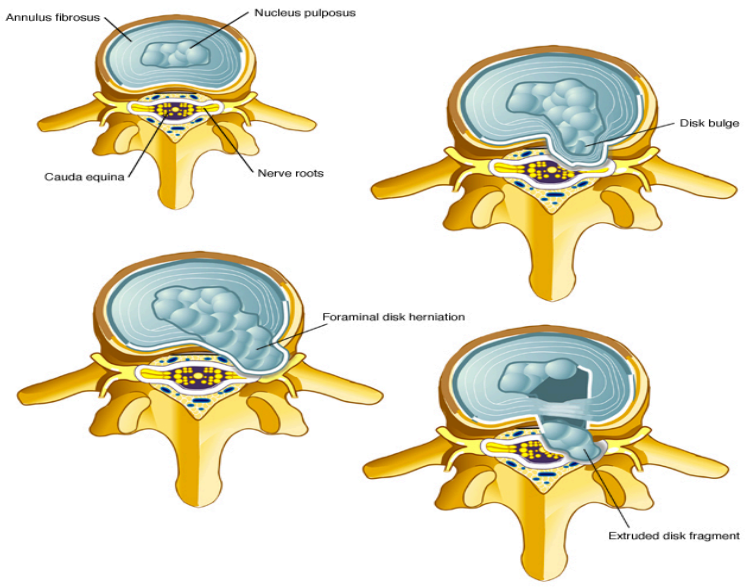

Figure 9 Types of herniated disks (27)

Radicular syndrome

Radicular syndrome develops in the relevant skin segment innervated by the spinal nerve and relevant muscles get week and loose the muscle tone and get atrophic. It can also develop loss of tactile sensibility accompanied by lower back pain, caused by compression of the meninges in the spinal canal or in the inter-vertebral canal. (36.) (*See Anatomy section of lumbar nerves to see which segment will lead to atrophy of given muscles.)*

Treatment:

Physiotherapy is the first treatment of choice in patients with symptoms caused by lumbar disc herniation. In clinical practice a broad range of physiothereutic modalities has been revealed helpful. During acute stage the efficacy of the McKenzie-concept, mobilization, and traction had been proven helpful. Training of local strength endurance of back and abdominal muscles in chronic stage should follow this. (28)

2.5 Current Therapeutic Approaches

There are a plethora of treatments available for the treatment of non-specific low back pain. Broadly speaking the treatments that is being used for non-specific low back pain are education, exercise, manual therapy, other non-pharmalogical interventions, psychological interventions, pharmacological interventions, and other invasive procedures.

2.5.1 Physiotherapy

The first line approach as a physiotherapist is to detect whether the pain is due to external factors producing excessive strain, or if it is due to an underlying cause, which leads to faulty statics and muscle imbalance. In case of the first mentioned main and leading therapy is to ***correct posture*** and dynamic overextension patterns. However, if second mention stated, the therapy should follow ***correction of statics*** and use of remedial exercise program. Patient with hypermobile syndrome are often exposed to excessive static loading, and attention in therapy should focus on the deep stabilizer system. Acute pain should be relived by treating trigger points using post isometric relaxation, soft tissue techniques, especially the fascia. (14) If necessary, pharmacotherapy or invasive procedures can be used.

Massage therapy

Massage is for the management of various pain-related conditions, especially those of musculoskeletal origin. It is associated with various effects that are potentially beneficial in the symptomatic treatment of low back pain. It relaxes the mind as well as the musculature and increases pain threshold, possibly through endorphin release. LBP is associated with a complex dysfunction of the paraspinal musculature. It is conceivable therefore that massaging these muscles could help normalize muscular dysfunction, and if not, at least relieve pain and symptoms in both acute and chronic phase. (12)

Physical therapy

Thermotherapy

Thermotherapy is a frequently used physical therapy for low back pain. It is divided into methods that use surface heat and methods that use deep heat, baths, hot springs that also have a mental-relaxation effect. In application of heat therapy not only does blood flow in local arterioles and capillaries increase, but sympathetic vasodilatation occur in distant areas as well. Local metabolism also accelerates; nerve sensitivity decreases, and the pain threshold rises. The sensitivity of muscle spindles, nerve endings that affect muscle tonus, decreases in response to heat, and muscle spasms are prevented. The extensibility of connective tissue increases, and joint contractures are relieved. The increase in muscle blood flow is also associated with the removal of substances related to fatigue and pain-inducing substances within the muscle. In this way heat has a rapid effect in relieving low back pain. (32)

Scar therapy

After surgery, the tissue surrounding the surgery site forms scar tissue as part of the healing process. With back and abdominal surgery, the scar tissue can also sometimes form an adhesion. This means that tissue hardens onto other structures internally. Active scar formation in the soft tissue can interfere with the elasticity and shifting movement of the various layers, if the scar is dysfunctional.
Active scar tissue can cause altered locomotor system function in the acute, subacute and chronic stages following a trauma or a surgery. There are several approaches to treating active scars. Manual treatment of scar tissue can effectively resolve the condition. (40)

Soft tissue manipulation (according Lewit)

Soft tissue, in particular the deeper layer including the fascia and the connective tissue, is intimately connected with the locomotor system, muscles, and joints. It is the function of soft tissue to be stretchable while yet able to resist stretch. It should take place in harmony with the locomotor system and may involve considerable ranges of movements.

Clinically, a physiological and a pathological barrier can be detected in all soft tissues. It is important to be enabling to find these changes and correct them to avoid reflex inhibition of the locomotor system.
It can be useful to use both skin stretching, applying pressure and restore deep tissue mobility. (14)

Post-isometric relaxation

Post-isometric relaxation (PIR) is the specific therapy for muscle tension with or without TrPs. The first step is to take up the slack by lengthening the muscle so to enlarge the barrier. It is effective not only for TrPs in muscle, but on the points where tensed muscles attach to the periosteum, and on referred pain in particular. PIR is painless and suitable for self-treatment setting. (14)

Correction of breathing

The muscle tonus increases and decreases rhythmically with breathing movements. (36) The most serious fault in breathing is clavicular breathing in which the thorax is lifted during inhalation. When this occurs, the tensed scalenes take over the activity of the diaphragm, which means that the deep stabilizers are no longer able to function, as they should. (14) As physiotherapist it is important to use the breathing movement as a tool to achieve affectively the facilitation or the relaxation of muscles. The effect increases by prolonging the apnoetic pause. (36) The first steps in therapy of lumbago with a patient with default breathing pattern are to restore coordinated activity between the diaphragm and the deep abdominal muscles. (14)

Manipulation of blocked joints (according to Lewit)

Manipulation is indicated if there is functional movement restriction of spinal motion segment, and if this is considered relevant for the patient´s symptoms. Gentle mobilization or high-velocity, low amplitude (HLVA) thrust is indicated on patients with non-specific low back pain where disc herniation is excluded. (14) The goal of the therapy is to return disturbed segments to their neutral position and thereby relieve stress on affected surrounding tissues.

Remedial exercises

In this part of a therapy session the patient learns to use his or hers own muscles to restore joint mobility, to relax their own TrPs and also to treat soft tissue parts that they can reach themselves. It is also intended to teach the patient how to correct a faulty movement pattern that has been diagnosed and considered as influencing the patient´s problem. (14)

McKenzie

McKenzie purposed the use of repeated movements and sustained positions in the examination and treatment of low back pain disorders. Patients with non –specific low back pain is referred to as individuals with postural syndrome who have intermittent episodes of pain believed to be the result of prolonged stress on soft tissues around the lumbar spine. (33)

Exercise therapy (strengthening exercises)

Exercise therapy relieves low back pain in both sub-acute and chronic stages. It is important to strengthen the lumbar and abdominal muscles. Increased strength in lumbar muscles will be more capable of holding the upper back in relation to the lower back working as a pivot. The abdominal muscles acts as a natural corset, and contribute to raising the pressure in the abdominal cavity reducing the load in the lower back. (32)

There is no ultimate answer to how a patient with back pain should train and is moreover up to each individual. With respect to intensity, duration and frequency the therapist and the patient can choose activity that suits the individual best. The goal is to gradually strengthen the muscles by using techniques and numbers of repetitions tailored to each individual´s physical constitution. It is well documented that strength training has effect with low back pain, and choice of exercises should be adapted to the patients' main problem areas and cause of symptoms. (31)

2.5.2 Pharmacotherapy

Pharmacotherapy

Pharmacotherapy for low back pain is used in conjunction with – not in lieu of – nack care education. It should be applied in parallel with physiotherapy and other active therapeutically approaches. (11)

Drugs form one part if the management of back pain and treatment of acute low back pain should start with administration of drugs. Analgesics and nonsteroideal anti-inflammatory drugs are typical first-line options. Paracetamol is normally the primary medication option. NSAIDs and/or weak opioids are recommended if paracetamol provides insufficient pain relief. Strong opiates should only be used for severe pain. (10)

Local injections

Local injections are used in the case of failure of other forms of conservative treatment. The local injections are given directly to the source of pain and consist of analgesics and anti-inflammatories. The goal is to remove the source of pain and relieve muscle tension.

2.5.3. Invasive procedures

Acupuncture

Acupuncture can be useful to decrease local pain, however, it is only used as temporary pain relief rather than removal of the essence of the problem. (14)

2.6 Prognosis

The prognosis for each individual episode with acute non-specific low back pain is traditionally considered to be good. In a systematic review, it was found that 58% had experienced reduction in pain and disability in the course of one month, while 82% had returned to work during the same period. (23) However, many patients experience frequent recurrences, and their spinal health is therefor not perceived as ideal. In the same study, 73% had one or more relapses within a year. (23) Many of those with initial appearance of acute lumbago, develop chronic aliment.

As mentioned above, acute low back pain has a tendency to come back. Many have perceptibly a back that is vulnerable in given situations like heavy lifting, bad movement pattern, unfortunate work positions and bearing, and stress, which all contributes to relapse. It is important to account what exactly is making the low back pain worse, whether it is related to their profession, lifestyle, or training, and plan the rehabilitation considering this.

An important factor when speaking of the prognosis is to have in mind that there is difference between patients with acute lumbago and patients with sub-acute and chronic low back pain. Often the patients with acute or persistent low back pain improve markedly in the first weeks of therapy. For patients with chronic stages the improvement tends to appear slower.

There are several clinical important prognosis factors but the most essential part for long-term recovery and optimal outcome will be both the educational part that the therapist have with the patient, together with continued exercise after symptoms disappears. It is vital that the patient understand the diagnosis and that he or she is able to follow given instructions.
Exercise therapy is the sole educational form of physical therapy for low back pain, and it demands an effort on the part of patients, but if patients can learn muscle strengthening and make it a regular habit, it is a “good medicine” that they can take with them wherever they go.

3 Special Part

3.1 Methodology

My bachelor practice took place at the private clinic Monada in Prague from 03.02.2014 until 14.02.2014. Monada is a complete rehabilitation center, which combines classical European medical rehabilitation with verified methods of natural medicine. The clinic employs 6 physicians in the fields of medical rehabilitation and neurology and 34 other professions with university, higher vocational or secondary school education. The clinic cooperates closely with foremost clinical workplaces in the fields of neurosurgery and orthopedics.

My case study where underdone at the department of physiotherapy. My supervisor was specialized in diagnosis like acute and chronic back pain, spinal disc herniations, conditions following spinal surgery and orthopedic surgery, functional disorders and muscular dysbalances, and especially pelvic diaphragm problems. Each physiotherapist has their own office with bench and equipment for exercise like fitness balls, record, ergometer cycle, etc. The department also offers varies therapies of physical therapy like magneto-therapy, ultrasound, shock wave therapy, etc.

My patient underwent a total of 5 therapies in the period of 6th to 14th of February 2014. Mrg. Veronica Sedlaská supervised my study and all examinations and therapeutical approaches were done in cooperation with her. We did the initial examination together and discussed and sat plans for the rehabilitation. Each session has been noted and the final examination is put together with the initial to see the clear results.

My patient was informed from the beginning, and my work has been approved by the Ethics Committee of the Faculty of Pysical Education and Sport at Charles University in Prague with the approval number XXXX.

3.2 Anamnesis

Performed 06.02.2014

Name: P.L, Female
Year of birth: 1978

Status praesens:

Height: 177 cm **Weight:** 88 kg **BMI:** 28.1

1st day at the clinic

Diagnosis:

M545 Lumbago

Summary of diagnosis
Low back pain in correlation with musculoskeletal system and connective tissue

Chief Complaint:
The patient has pain in the lumbar spine without any pain radiating to any over her legs. The patient says that she is used to having low back pain from time to time, but that it usually disappears by it self after a few days and that this didn´t happen this time. The pain is described as sticking pain and on a pain scale from 1-10 she considers it between 6-7. The pain is mostly present during movement, and especially when she goes from sitting to standing visa versa and when she wants to change position in bed. During night she tells us that she sometimes wakes up because of intense pain in the lumbar area. She tells us that she sometimes wakes up during night because of intense pain in the lumbar area and she describes the pain as "heaviness" as she was lying in something very hard. She also has a lot of problem lifting her baby, which is 6 months. She has no problem with incontinence.

History of present problem

The pain in the lumbar area started about 2 weeks ago. The patient says that she is used to having low back pain from time to time, but that it usually disappears by it self after a few days and that this didn´t happen this time

Medical history

Diseases

- Dysplasia - Developmental hip disease

Injuries

None

Past Surgeries

- 1993: Lower back surgery- L5 Decompression & discectomy
- 2005: Lower back surgery – L5 Decompression & discectomy
- 2004:Surgery of patella, right side
- 2004: Surgery of patella, left side
- 2008: Caesarean section
- 2013: Caesarean section

Pharmacotherapy

Missing – have to translate it

Allergies

Allergic to plasters

Family history

Mother had lumbar surgery once, after reconstruction of their house with a lot of heavy lifting. 2 sisters, which are healthy

Psychosocial history

- Contraception

- Infusion therapy every 3rd day from 05.02.2014:
    - Mesocain
    - Guajacuran

Occupation

Sedentary job - working in office. She is now on parental leave.

Living condition

Lives in flat with family

Married: Yes

Children: 2

ADL: She manages the activity of daily living OK and she gets trough it, but at points it is very hard

Smoking: No

Alcohol: Occasionally

Sport anamnesis

She has been playing volleyball, tennis, squash and done swimming before she got children.

Previous rehabilitation

The patient had rehabilitation on Malvazinky after her second back surgery. She stayed there for 10 days. During her pregnancy she had lower back pain as well and had two appointments at the Monada clinic where they did some Post Isometric Relaxation and Reflex Massage.

Indication of rehabilitation

The patient is indicated for infusion therapy and rehabilitation.

Differential considerations

- Degenerative changes of the lumbar spine
- Mechanical problems (compression)
- Blockage of joints in any part of the spine
- Structural changes due to scar tissue
- Osteoporosis
- Coccyx Pain
- Changes in muscle tone
- Changes of posture
- Joint Hypermobility

3.3 Initial Kinesiologic Examination

Performed 06.02.2014

3.3.1 Posture examination

Posterior:

Head: Slight rotation to the left – the head lies more to the left side of the plumb line

Shoulders: Elevated, right slightly more

Scapulaes: Abduction of angulus inferior (more on right side) – the scapulae are moved away from the midline, winging (more on right side) – the medial borders of scapulae lift off ribs

Trunk: Lateral deviation – the spinous processes of the vertebrae are lateral (left) to the midline of the trunk

Pelvis: Neutral

Gluteal lines: Left is higher

Knees: Hyperextension, genu varum

Ankle: Pes planus

Lateral - left:

Head: Forward – the head lies anterior to the plumb line

Cervical: Hyperlordotic curve of cervical spine

Shoulders: Slighty forward – the acromion process lies anterior to the plumb line; the scapulae are abducted

Thoracic: Hyperkyphosis – increased posterior convexity of the vertebrae, top of curve in CT junction which is even more prominent

Lumbar: Flattened lordotic curve

Hip: Neutral

Knee: Hyperextension – the plumb line falls anterior to the joint axis

Ankles: Forward posture – the plumb line is posterior to the body; body weight seems to be carried on the metatarsals heads of the feet

Lateral – right:

Confirmation of the right side

Anterior:

Head: Forward

Shoulders: Slightly forward, elevated, medial rotation, Right clavicle slightly higher

Elbows: Semi-Flexed

Trunk: Shifted to the left, depressed, abdomen is prominent with umbilicus pointing up

Hip: Medial rotation

Knee: Internal tibial torsion – the feet face directly inward

Ankle: Slight plantar flexion

Feet: Hallux rigidus

3.3.2 Pelvis examination

Crest:

Same level

Posterior superior iliac spines:

Same level

Anterior superior iliac spines:

Same level

ASIS & PSIS (right side):

PSIS slightly higher

ASIS & PSIS (left side)

PSIS slightly higher

Result: Patient has physiological anterior pelvic tilt

3.3.3 Gait examination

- Head and trunk are shifted throughout cycle
- Both arms are parallel with body, left arm swings more
- Short steps
- Unstable
- External rotation in hip
- Flat foot and coxa vara during landing

Walking backwards: Extension of hip
Walking on heels (L5 root syndrome): Able to do it, but very unstable
Walking on toes (S1 root syndrome): Able to do it
Semi-squat (L4 root syndrome): Able to do it

3.3.4 Dynamic tests of back

Backward bend:
The range of motion is small. Patient only extends the spine in thoracic part and cervical part of the spine. The lumbar spine is flat during this movement. Patient feels small pain in lower back during movement.

Lateral side right:
Patient small ROM during the bend to this side, do not feel any pain. The movement in lumbar spine is stiff and without any curve. The patient keeps the balance by tilting the femur to keep the weight centered to the right side.

Lateral side left:
Small ROM. Lumbar and thoracic is flat. Stable pelvis.

Flexion:

The patient bends very slowly down and seems to be afraid during the movement. The lumbar spine is again flat. She tends to bend more to the right side and not straight down during the movement. Although, it is not a typical painful arch while bending.

3.3.5 Special Tests

Scale Test:
Right foot: 46
Left foot: 42
Result: Physiological

Thomayer´s: 25 cm
Trendelenburg: Negative
Lasegue: Negative
Test for Femoroacetabular Impingement Syndrome: Negative

3.3.6 Scar examination

On abdomen after C-section

- The scar is approximately 10 cm long
- The scar is quite deep, and even deeper on the lateral side
- No pain during palpation
- Inflexible
    - Stretching the scar is difficult and with hard barrier
- Hyper-pigmented

3.3.7 Breathing Examination

The patient has upper chest breathing. She is lifting her chest up during inhalation. She is using her abdominal muscles during exhalation and does clearly not do this passively. There is absence of lateral excursion of the lower ribs. Elevation of the upper rib cage, sternum and clavicles are noticed during inhalation.

3.3.8 Neurological Examination:

Noncortical sensory system

Segment in light touch	Right	Left
L1	Normal	Normal
L2	Normal	Normal
L3	Normal	Normal
L4	Normal	Normal
L5	Normal	Normal
S1	Normal	Normal
S2	Normal	Normal
S3	Normal	Normal

Table 2 neurological examination: Light touch – Initial examination

Segment in sharp pain	Right	Left
L1	Normal	Normal
L2	Normal	Normal
L3	Normal	Normal
L4	Normal	Normal
L5	Normal	Normal
S1	Normal	Normal
S2	Normal	Normal
S3	Normal	Normal

Table 3 Neurological examination: Sharp pain –Initial examination

Examination of deep tendon reflexes:

Reflex	*Right*	*Left*
Patellar reflex (L2-L4)	2	2
Ankle reflex (S1)	1	2

Table 4 Neurological examination: Deep tendon reflexes – Initial examination

3.3.9 Range of Motion Examination

Measurements according to Kendall

Hip joint

	Left	**Left**	**Right**	**Right**
	Active	Passive	Active	Passive
F	125	125	125	125
E	5	10	5	10
ADD	10	10	10	10
ABD	45	45	45	45
ER	30	35	30	30
INT	40	45	45	45

Table 5 ROM Hip joint - Initial examination

3.3.10 Hypermobility examination

Measurements according to Sachse

Test	**Grade**	
Back retroflexion	A	
Flexion of trunk	(not even touching the ground)	
Lateral flexion of trunk	To the right side: A	To the left side: A
Arms behind the head	B	B
Rotation of cervical spine/head	B	B
Elbow joint extension with clasped forearms	B	
Putting palms to each other	B	B
Putting fingers to each other	A	A

Scarf test – contact of hand around neck	Right hand: C	Left hand: C
Extension of knees	Right: B	Left: B

Table 6 Examination of hypermobility - Initial examination

3.3.11 Manual Muscle Length Examination

Measurements according Janda approach

Muscle/muscle group	Right	Left
Pectoralis major, upper fibers Pectoralis major, lower fibers	1 0	1 0
Pectoralis minor	0	0
Triceps surrae	0	0
Hip flexors: Tensor fascia lata: Rectus femoris: Iliopsoas:	 1 0 1	 1 0 1
Hip adductors	1	1
Piriformis	1	1
Hamstrings	0	0

Table 7 Muscle length test - Initial examination

3.3.12 Examination of Muscle Strength

According to the Oxford Scale

Muscle	Right, grade	Left, grade
Gluteus Maximus	5	5
Gluteus Medius	5	5
Gluteus Minimus	5	5
Hip Adductors (Pectineus, Adductor Magnus, Gracilis, Adductor Brevis, Adductor Longus)	5	5
Tensor Fasciae Latae	5	5
Iliopsoas	5	5
Quadriceps Femoris	5	5
Biceps Femoris	5	5
Semitendinosus & Semimembranosus	5	5
Gastrocnemius	5	5
Soleus	5	5

Table 8 Muscle Strength Test - Initial examination

3.3.13 Examination of Basic Movement Patterns

Hip extension:

Right foot: Alterned pattern

- Unstable, trunk shifts to opposite side during movement

Left foot – Physiological pattern

Hip abduction:

Left foot - Physiological pattern

Right foot – Altered pattern

- Quadratus mechanism

3.3.14 Palpation

Examination of fascial structures:

- **Thoracolumbar fascia:** Tight in both cranial and caudal direction

- **Anterior fascial compartment of thigh** (Quadriceps)**:** Tight
- **Posterior fascial compartment of thigh (**Biceps femoris, semitentinosus, semimembrnosus)**:** Slightly pathological barrier in longitudinal axis
- **Medial fascial compartment of thigh** (Pectineus, gracilis, aduuctor longus, brevis, magnus)**:** Normal

- **Anterior compartment of leg** (Tibialis Anterior, Extensor Hallucis Longus, Extensor Digitorum Longus, Peroneus Tertius)**:** Normal
- **Posterior compartment of leg**
    - **Superficial structures** (Gastrocnemius, Soleus, Plantaris)**: Tight**
    - **Deep structures** (Tibialis Posterioir, Flexor halluces longus, Flexor digitorum longus, Popliteus)**:** Normal

- **Posterior fascial compartments of neck** Scalene, Levator Scapula, Upper Trapezius)**:** Tight

3.3.15 Muscle tone examination

Muscle	**Left side**	**Right side**
Quadratus lumborum	Hypertonic, TrP	Hypertonic
Diaphragma (costal part)	Tension	Tension
Erector spinae (lumbar)	Hypertonic	Hypertonic
Erector spinae (thoracic)	Normal	Normal
Short adductors of hip (pectineus, adductor brevis and longus)	Hypertonic (painful)	Hypertonic (painful)
Iliacus	Hypertonic	Hypertonic
Rectus femoris	Normal	Normal
Triceps Surae	Normal	Hypertonic, TrP
Piriformis	Hypertonic	Hypertonic

Table 9 Examination of muscle tone - Initial examination

TrP = Triggerpoint

3.3.16 Examination of joint play

Measurements according to Lewit (14)

Joint	**Left side**	**Right side**

Sacroiliac joint	No blockage	No blockage
1st Lumbar (S, F, E)	No blockage	No blockage
2nd Lumbar (S, F, E)	No blockage	No blockage
3rd Lumbar (S, F, E)	No blockage	No blockage
4th Lumbar (S, F, E)	No blockage	No blockage
5th Lumbar (S, F, E)	No blockage	No blockage
1st Thoracic (S)	No blockage	No blockage
2nd Thoracic (S)	No blockage	No blockage
3rd Thoracic (S)	No blockage	No blockage
4th Thoracic (S)	No blockage	No blockage
5th Thoracic (S)	No blockage	No blockage
6th Thoracic (S)	**Restricted E, S**	**Restricted E, S**
7th Thoracic (S)	**Restricted E, S**	**Restricted E, S**
8th Thoracic (S)	No blockage	No blockage
9th Thoracic (S)	No blockage	No blockage
10th Thoracic (S)	No blockage	No blockage
11th Thoracic (S)	No blockage	No blockage
12th Thoracic (S)	No blockage	No blockage

Table 10 Examination of joint play - Initial examination

F = Flexion

E = Extension

S = Springing

3.3. 17 Conclusion of examination

During the postural examination I found that she dominantly is standing on her right foot, which makes her overall posture to shift to the left. Her spinous processes of the vertebrae are lateral (left) to the midline of the trunk. She has a flattened lordotic curve and a hyperkyphotic thoracic curve. She also has a dominant cervical lordosis and a pronated CT-junction.

The most important findings during the postural examination are her disability to perform basic movements, which I could see during the dynamic testing of her back and the gait examination. She is clearly in a lot of pain during movement.

An other important finding during the exam was the scar. The scar is healed, but the flexibility is limited and the color is dark. The scar is also quite deep in her abdomen, meaning that there may be underlying soft tissue damage.

The neurologic exam was focused mainly on sensation, muscle strength and reflexes with emphasis on the L4, L5 and S1 nerve roots and primary dermatomal mapping. The exam was without any pathological findings and possible nerve root compromise. Absence in the straight leg raise (Lasegue) confirms that there is not likely that there are any discogenic source of pain.

The basic movement patterns show no altered pattern, but instability in the pelvis and trunk while performing hip extension. Overall the results were symmetrical and consistent.

The hypermobility tests show us that she has increased hypermobility especially in the shoulders and knees, which can be a contributor to her musculoskeletal instability.

During palpation I found tight fascial structures in the lower back and both lower extremities. She also had tight and hypertonic muscles of both hip and back. Tenderness and Hypertonus were localized in her paravertebral muscles in the lumbar area. The muscle Quadratus Lumborum, Pirformis and Iliopsoas on both sides were also in hypertonus.

She has no blockage in any of the vertebras or SI joint, but complaints about pain during springing in all of the segments.

Other mentions: She does not have any problems with urinary incontinence.

To conclude the initial examination – her main problems is related to her postural alignment and muscular imbalance. I suggest that the repeated movements and

especially her sustained postures in sitting and standing has led to adaptations in muscle length, strength and stiffness; which in turn has led to movement impairments as well. The rehabilitation plan will be conducted according to these findings and the main focus will be directed toward restoring motion in both upper and lower back by stretching and relaxing the shortened and tight soft tissue, strengthening the weaker muscles, especially the deep stabilizers and correcting her breathing pattern dysfunction.

3.4 Rehabilitation plan

Short-term rehabilitation plan

- Decrease pain
- Correct and improve her upper chest breathing into abdominal breathing
- Relaxation of tight and hypertonic muscles
- Release tight fascia in lower back and lower extremities
- Educate and correct accurate sitting and standing positions
- Avoid bed rest
- Educate exercised for self therapy

The main goal during the short-term rehabilitation will be to decrease her amount of pain. Even though she is able to perform ADL her pain is a huge barrier for her considering that she also has a small child and a baby to take care of. It is important to educate her in different situations in daily living like how to pick up her child in correct way, how to sit and stand, etc. She should actively participate in, and be responsible for, her rehabilitation program. It is also important to make her understand that it is important try to remain active, and resume normal light duty activities.

Long-term rehabilitation plan

- Minimize the risk of recurring pain (avoid painful postures and movements)
- Get back to activity and remain active
- Improve overall fitness and exercise in closed and open chain

3.5 Therapy Progress:

Day to day therapy – Day 1

Date: 06.02.2014 Time: 09.00

Status before therapy: Patient is in a lot of pain before the therapy starts. She says that she is tired and that the prior examination was fatiguing.

Goal of today´s therapy unit:

- Pain management
- Correct breathing pattern
- Remodeling of scar tissue
- Increase extension in thoracic spine
- Educate patient in exercises for self therapy

Therapy implementation:

- Thermotherapy: Hot roll on the sore area for a short duration to relieve pain

- Diaphragmatic breathing exercises
  - Supine position
  - Patient is asked to breath all the way down in the abdomen
  - Manual compression of the lower ribs is performed to help facilitate abdominal breathing and to encourage activation of the abdominal muscles during exhalation
- Segmental breathing exercises
  - "Breath into my hands" – in different places of the chest and thorax to actively direct air into specific areas

- Scar Therapy/Taping
  - Light stretching and pulling on the scar followed by taping

- Thoracic extension exercise according to Lewit
    - Mobilization into extension
        - Patient is seated on a stool facing the wall
        - Patient stabilizes both knees (slightly apart) and with crossed arms against the wall, resting the head on the arms.
        - I am placing one hand on the patient´s stiffened kyphotic thoracic spine to indicate where she should be focused.
        - Patient relaxes into extension
        - When maximum extension has been reached I ask the patient to press lightly against my hand and to breath in deeply and slowly, breath-hold, and then breath out slowly and completely.
        - She then relaxes back into extension
        - Repeated 5 times

Result:

Subjective: The patient thought it was difficult changing the breathing pattern without inhaling more air than on a normal inhalation and without relaxing the abdominal muscles.
She is able to perform the extension exercise of the thoracic spine without any problem and without provoking pain.

Objective: The patient was not able to breathe all the way down in the abdomen without contracting the abdominal muscles in a concentric way. We want her to contract the abdominal muscles in an eccentric way and she had problems performing this. Although, it got a little better when the supervisor pressed her lower ribs posteriorly.

Self-Therapy:

- Breathing exercise
    - The patient will try to learn how to breathe with abdominal breathing without contracting the abdominal muscles in a concentric way. She can put her forearm on her lower ribs to help facilitate relaxation of the abdominal muscles.
- Mobilization into extension (5 repetitions, 3 times a day)

Day to day therapy – Day 2

Date: 07.02.2014 Time: 12.00

Status before therapy: Patient feels tired after yesterdays therapy and she said that she had acing pain in her back muscles at the evening. She was aware that it probably was due to yesterdays exercising.

Goal of today´s therapy unit:

- Pain management
- Increase extension in thoracic spine
- Relax soft tissue in lower back and lower extremity
- Relax hypertonic and short m quadratus lumborum and m. iliopsoas
- Correction of breathing pattern
- Correcting of sitting position

Therapy implementation:

- Thoracic extension exercise according to Lewit (see instructions on Day to day therapy – Day 1)
- Soft tissue manipulation according to Lewit
    - Shifting and stretching the dorsal fascia cranially
    - Shifting and stretching the deep lumbar fascia caudally
- Post isometric relaxation according to Lewit
    - M. Quadratus lumborum
    - M. Iliopsoas
- Correction of breathing pattern
- Correction of sitting position

Result:

Subjective: During PIR of both the quadratus lumborum and iliopsoas she felt pain in the beginning, especially on the right side. When the therapy was done she said that she felt taller.

Objective: Her posture improved after today´s therapy and she was standing straighter. The breathing improved a lot and she was able to do it without tightening the abdominal muscles.

Self-Therapy:

- Breathing exercises
- Mobilization into thoracic extension
- Gravity induced PIR of iliopsoas
- Correction of sitting

Day to day therapy – Day 3

Date: 10.02.2014 Time: 12.00

Status before therapy: The patient says that she has been exercising during the weekend and that she feels more relaxed in the back. She says that the breathing exercises helps for relaxing her back. The pain is still present when she changes position in bed and during squat/bending movements. She is in good condition and motivated for the session.

Goal of today´s therapy unit:

- Decrease pain
- Increase extension in thoracic spine
- Improve breathing pattern
- Check correct sitting position
- Relax m. quadratus lumborum, m. piriformis and m. iliopsoas
- Centralize the cervical spine to neutral position

Therapy implementation:

- PIR-induced mobilization into extension of thoracic spine in side-lying position according to Lewit
- Improve breathing pattern
- Correct sitting position
- Post isometric relaxation of m. quadratus lumborum, m. piriformis and m. iliopsoas

Result:

Subjective: She felt the PIR-induced mobilization relaxing and effective. She said again that she felt "taller" when standing up.

Objective: I tried a new mobilization technique with the patient for extension of thoracic spine because she is now able to do the self-therapy exercise good by her self.

When I checked her sitting posture I could see that she was overextending her lower back as she was trying to sit straight. Correction was made for this.

Self-Therapy:

- Breathing exercises
- Mobilization into extension of thoracic spine
- Retraction of cervical spine according to McKenzie

Day to day therapy – Day 4

Date: 12.02.2014 Time: 11.00

Status before therapy: The patient is in good mood before the session. Although, she feels that she has had a little setback. She felt much better after the weekend with exercising at home and that she now feels sore again after the session on Monday. Yesterday she was not able to pick up her oldest child. We explained to her that the soreness could come from the exercising we did on Monday and that the body probably will recover soon. She also says that she is more stiff and sore in the thoracic spine now than before.

Goal of today´s therapy unit:

- Remodeling of scar tissue
- Increase extension in thoracic spine
- Relax iliopsoas, rectus femoris, pectoralis major, m. pectroalis minor
- Mobilization of thoracic spine
- Activate costal part of diaphragm

Therapy implementation:

- Scar Therapy/Taping
    - Light stretching and pulling on the scar followed by a new tape
- PIR-induced mobilization into extension in side-lying position according to Lewit
- Post isometric relaxation of
    - M. iliopsoas (bilaterally)
    - M. rectus femoris (bilaterally)
    - M. pectoralis major (bilaterally)
    - M. pectroalis minor (bilaterally)
- Traction of thoracic spine (provided by supervisor)
- Kinesio tape for activation of costal part of diaphragm

Result:

Subjective: She felt the mobilization in both extension and traction pain relieving.
Objective: The result PIR of the iliopsoas and rectus femoris were profitable right away. As for the pectoralis minor and major, especially on the right side.

Self-Therapy:

- Breathing exercises
- Remodeling of scar tissue
- Mobilization into extension (10 extensions, 3 times a day)
- Retraction of cervical spine according to McKenzie (15 retractions, 6 times a day)
- Conditioning/Be active

Day to day therapy – Day 5

Date: 14.02.2014 Time: 11.00

Status before therapy: The patient feels better today then since last visit at the clinic two days ago. She tells us that the pain has disappeared when changing position from sitting to standing. Even though, since yesterday she has felt a type of sharp pain that something is supposed to "pop". Overall she is feeling good.

Goal of today´s therapy unit:

- Increase extension in thoracic spine
- Segmental control over primary stabilizers (multifidus, transversus abdominis)
- Correct/educate good back techniques at home/daily life
- Discuss further rehabilitation

Therapy implementation:

- PIR-induced mobilization into extension in side-lying position according to Lewit
- Activation of m. transversus abdominis in four point kneeling and increasing spinal mobility ("Camel-Cat position")
    - Patient in hands and knees position on an exercise mat
    - Knees is positioned underneath the hips and the crease of the wrist directly under her shoulders
    - Patient is engaging the core and abdominal muscles while she is keeping the spine in a neutral position. Shoulder blades are pulled towards the hip
    - Upward (Cat): Patient uses abdominal muscles to push the spine upwards towards the ceiling.
    - Position is hold for 10-15 seconds
    - Downward (Camel): Using the abdominal muscles and lower back muscles to tip the tailbone toward the ceiling allowing the abdomen to stretch toward the floor.
    - Position is hold for 10-15 seconds
    - Repeated 10 times

- Education in using good back techniques in different positions
    - Explaining that bending/flexing the back should be avoided; bending instead at the knees or at the hips while lifting objects, tying shoes, pitting socks on etc.

Result:

Subjective: The patient does not feel any pain during exercising. She has finds the therapy relaxing and helpful for her pain. She says that during extension of thoracic spine she feels "taller" for each time.

Objective: The patient has improved her ROM in the thoracic spine a lot. It is not so stiff anymore and she is able to relax during the PIR induced mobilization. It is a good way to start off the session each time, due to pain relieve and the fact that we can see that the exercise is really effective. It mobilizes the spine in the way that she is more upright during the following exercises and that she feels more stabile and durable.

Self-Therapy:

- Breathing exercises
- Mobilization into extension (10 extensions, 3 times a day)
- Retraction of cervical spine according to McKenzie (15 retractions, 6 times a day)
- General conditioning/strengthening exercises for Lumbar/Core strength and Stability:

    Every exercise should be performed in repetition of 10 and sets of 3. Every top position of the movement should be hold for 5 seconds before returning to start position. The exercises should be performed 3 times a week

    - **Pelvic Lift** (for back and buttocks/hamstrings)
        - Supine position with hips and knees to 90 degrees angle with feet flat on foor and arms palm-down at sides; slowly raising the butt of the floor until torso is in linw with thighs
    - **Prone Bridging on Elbows**

        - Hold for 15 sec-1 min. Progress in increments of 15 seconds)
    - **“Cat-Camel”** (see “Therapy Implementation – Day 5” for instructions”
    - **Prone Cobra´s**
        - Supine position, with arms at side; lift head and chest off the floor; contract glutes tight and squeeze shoulder blades together, hold and return to starting position
    - **Quadruped Opposition arm/leg** (for shoulders and upper back, lower back, buttocks and hamstrings)
        - Position on all fours; knees at 90 degrees; use hamstrings, glutes and low back muscles to lift the leg straight simultaneously lifting opposite arm

3.6 Final Kinesiologic Examination

Performed 14.02.2014

3.6.1 Examination of posture

Posterior:

Head: Slight rotation to the left – the head lies more to the left side of the plumb line

Shoulders: Elevated, right slightly more

Scapulaes: Abduction of angulus inferior (more on right side) – the scapulae are moved away from the midline, winging (more on right side) – the medial borders of scapulae lift off ribs

Trunk: Midline

Pelvis: Neutral

Gluteal lines: In line

Knees: Hyperextension, genu varum

Ankle: Pes planus

Lateral - left:

Head: Forward – the head lies anterior to the plumb line

Cervical: Hyperlordotic curve of cervical spine

Shoulders: Slighty forward – the acromion process lies anterior to the plumb line; the scapulae are abducted

Thoracic: Slightly hyperkyphotic – increased posterior convexity of the vertebrae, top of curve in CT junction which is even more prominent

Lumbar: Flattened lordotic curve

Hip: Neutral

Knee: Hyperextension – the plumb line falls anterior to the joint axis

Ankles: Forward posture – the plumb line is posterior to the body; body weight seems to be carried on the metatarsals heads of the feet

Lateral – right:

Confirmation of the right side

Anterior:

Head: Slightly forward

Shoulders: Slightly forward, elevated, medial rotation, Clavicles in same line

Elbows: Semi-Flexed

Trunk: **Sternum in line with plumb line**

Hip: Medial rotation

Knee: Internal tibial torsion – the feet face directly inward

Ankle: Slight plantar flexion

Feet: Hallux rigidus

3.6.2 Examination of pelvis

Crest:

Same level

Posterior superior iliac spines:

Same level

Anterior superior iliac spines:

Same level

ASIS & PSIS (right side):

PSIS slightly higher

ASIS & PSIS (left side)

PSIS slightly higher

Result: Patient has physiological anterior pelvic tilt

3.6.3 Gait examination:

- Head and trunk are upright throughout the cycle

- Short steps
- Stable
- External rotation in hip
- Flat foot and coxa vara during landing
- Swings equally with both arms

Walking backwards: Extension of hip
Walking on heels (L5 root syndrome): Able to do it, stable
Walking on toes (S1 root syndrome): Able to do it
Semi-squat (L4 root syndrome): Able to do it

3.6.4 Dynamic tests of back:

Backward bend:
The range of motion is small. The patient extends in both thoracic and lumbar spine. No pain during movement.

Lateral side right:
Patient small ROM during the bend to this side, do not feel any pain. The movement in lumbar spine is stiff and without any curve. The patient keeps the balance by tilting the femur to keep the weight centered to the right side.

Lateral side left:
Small ROM. Lumbar spine is flat. Thoracic has a harmonic curve during movement. Stable pelvis.

Flexion:
We can see rounding during the bending and there is also small motion in the lumbar spine. There is no discomfort during the motion except from a "stretching" kind of pain in the bottom position. She is not able to reach the floor. She is bending straight downwards.

3.6.5 Special Tests:

Scale Test:

Right foot: 45

Left foot: 43

Result: Physiological

Thomayer´s: 15 cm

Trendelenburg: Negative

Lasegue: Negative

Test for Femoroacetabular Impingement Syndrome: Negative

3.6.6 Breathing Examination

- Abdominal breathing during inhalation
- Relaxes the pressure in the abdomen during exhalation
- Slight pressure on the lateral border of lower ribs
- 1:2 ratio of inhalation and exhalation

3.6.7 Neurological Examination:

Noncortical sensory system

Segment in light touch	Right	Left
L1	Normal	Normal
L2	Normal	Normal
L3	Normal	Normal
L4	Normal	Normal
L5	Normal	Normal
S1	Normal	Normal
S2	Normal	Normal
S3	Normal	Normal

Table 11 Neurological examination: Light touch - Final examination

Segment in sharp pain	Right	Left
L1	Normal	Normal
L2	Normal	Normal
L3	Normal	Normal
L4	Normal	Normal
L5	Normal	Normal
S1	Normal	Normal
S2	Normal	Normal
S3	Normal	Normal

Table 12 Neurological examination: Sharp pain - Final examination

Examination of deep tendon reflexes:

Reflex	*Right*	*Left*
Patellar reflex (L2-L4)	2	2
Ankle reflex (S1)	1	2

Table 13 Neurological examination: Deep Tendon Reflexes - Final examination

3.6.8 Manual Muscle Length

According to the Janda Approach

Muscle/muscle group	Right	Left
Pectoralis major, upper fibers	0	0
Pectoralis major, lower fibers	0	0
Pectoralis minor	0	0
Triceps surrae	0	0
Hip flexors: Tensor fascia lata:	1	1

Rectus femoris: Iliopsoas:	0 **0**	0 **0**
Hip adductors	1	1
Piriformis	**0**	1
Hamstrings	0	0

Table 14 Manual muscle length - Final examination

3.6.9 Examination of hypermobility (according to Sachse):

Test	Grade	
Back retroflexion	A	
Flexion of trunk	(not even touching the ground)	
Lateral flexion of trunk	To the right side: A	To the left side: A
Arms behind the head	B	B
Rotation of cervical spine/head	B	B
Elbow joint extension with clasped forearms	B	
Putting palms to each other	B	B
Putting fingers to each other	A	A
Scarf test – contact of hand around neck	Right hand: C	Left hand: C
Extension of knees	Right: B	Left: B

Table 15 Examination of hypermobility - Final examination

3.6.10 Examination of Muscle Strength

According to the Oxford Scale

Muscle	Right, grade	Left, grade
Gluteus Maximus	5	5
Gluteus Medius	5	5
Gluteus Minimus	5	5
Hip Adductors (Pectineus, Adductor Magnus, Gracilis, Adductor Brevis, Adductor Longus)	5	5
Tensor Fasciae Latae	5	5
Iliopsoas	5	5
Quadriceps Femoris	5	5
Biceps Femoris	5	5
Semitendinosus & Semimembranosus	5	5
Gastrocnemius	5	5
Soleus	5	5

Table 16 Examination of muscle strength - Final examination

3.6.11 Examination of movement patterns

Hip extension:

Right foot: Physiological pattern

Left foot – Physiological pattern

The patient shows instability while performing this movement.

Hip abduction:

Left foot - Physiological pattern

Right foot – Physiological pattern

Palpation

3.6.12 Examination of fascial structures:

- **Thoracolumbar fascia:** Physiologic barrier in caudal and cranial direction

- **Anterior fascial compartment of thigh** (Quadriceps)**:** Physiologic barrier
- **Posterior fascial compartment of thigh (**Biceps femoris, semitentinosus, semimembrnosus)**:** Physiological barrier (slight restriction)
- **Medial fascial compartment of thigh** (Pectineus, gracilis, aduuctor longus, brevis, magnus)**:** Pathological barrier in longitudinal axis

- **Anterior compartment of leg** (Tibialis Anterior, Extensor Hallucis Longus, Extensor Digitorum Longus, Peroneus Tertius)**:** Physiological
- **Posterior compartment of leg**
    - **Superficial structures** (Gastrocnemius, Soleus, Plantaris)**:** Pathological barrier in longitudinal axis
    - **Deep structures** (Tibialis Posterioir, Flexor halluces longus, Flexor digitorum longus, Popliteus)**:** Physiological

- **Posterior fascial compartments of neck** Scalene, Levator Scapula, Upper Trapezius)**:** Pathological barrier in longitudinal axis

Note: Lateral compartment of leg was not examined

3.6.13 Examination of muscle tone:

Muscle	Left side	Right side
Quadratus lumborum	Slightly Hypertonic, No TrP	Hypertonic
Diaphragma (costal part)	No tension	No tension
Erector spinae (lumbar)	Hypertonic	Hypertonic
Erector spinae (thoracic)	Normal	Normal
Short adductors of hip (pectineus, adductor brevis and longus)	Hypertonic (painful)	Hypertonic (painful)
Iliacus	Normal	Normal
Rectus femoris	Normal	Normal
Triceps Surae	Normal	Hypertonic, TrP
Piriformis	Normal	Slightly hypertonic

Table 17 Examination of muscle strength - Final examination

TrP = Triggerpoint

3.6.14 Examination of joint play:

Joint	Left side	Right side
Sacroiliac joint	No blockage	No blockage
1st Lumbar (S, F, E)	No blockage	No blockage
2nd Lumbar (S, F, E)	No blockage	No blockage
3rd Lumbar (S, F, E)	No blockage	No blockage
4th Lumbar (S, F, E)	No blockage	No blockage
5th Lumbar (S, F, E)	No blockage	No blockage
1st Thoracic (S)	No blockage	No blockage
2nd Thoracic (S)	No blockage	No blockage

3rd Thoracic (S)	No blockage	No blockage
4th Thoracic (S)	No blockage	No blockage
5th Thoracic (S)	No blockage	No blockage
6th Thoracic (S)	**No blockage**	**No blockage**
7th Thoracic (S)	**No blockage**	**No blockage**
8th Thoracic (S)	No blockage	No blockage
9th Thoracic (S)	No blockage	No blockage
10th Thoracic (S)	No blockage	No blockage
11th Thoracic (S)	No blockage	No blockage
12th Thoracic (S)	No blockage	No blockage

Table 18 Examination of joint play - Final examination

3.7 Therapy Effect Evaluation - Comparison

Main findings of initial and final examination:

Initial Examination	Final Examination
Posture *Posterior:* **Head:** Slight rotation to the left – the head lies more to the left side of the plumb line **Shoulders:** Elevated, right slightly more **Trunk:** Lateral deviation – the spinous processes of the vertebrae are lateral (left) to the midline of the trunk **Gluteal lines**: Left is higher *Lateral - left:* **Head:** Forward – the head lies anterior to the plumb line **Cervical:** Hyperlordotic curve of cervical spine **Thoracic:** Hyperkyphosis – increased posterior convexity of the vertebrae, top of curve in CT junction which is even more prominent *Anterior:* **Head:** Forward **Shoulders:** Slightly forward, elevated, medial rotation, Right clavicle slightly higher **Trunk:** Shifted to the left, depressed, abdomen is prominent with umbilicus pointing up	**Posture** *Posterior:* **Head:** Neutral position **Shoulders:** Elevated, in line **Trunk:** Midline **Gluteal lines**: In line *Lateral - left:* **Head:** Slightly forward – the head lies anterior to the plumb line **Cervical:** Slight hyperlordotic curve of cervical spine **Thoracic:** Slightly hyperkyphotic – increased posterior convexity of the vertebrae, top of curve in CT junction which is even more prominent *Anterior:* **Head:** Slightly forward **Shoulders:** Slightly forward, elevated, medial rotation, Clavicles in same line **Trunk: Sternum in line with plumb line**

Gait examination: • Short steps • Unstable • External rotation in hip • Flat foot and coxa vara during landing • Swings more with left arm	**Gait examination:** • Head and trunk are upright throughout the cycle • Short steps • Stable • External rotation in hip • Flat foot and coxa vara during landing • Swings equally with both arms
Dynamic tests of back: *Backward bend:* The range of motion is small. Patient only extends the spine in thoracic part and cervical part of the spine. The lumbar spine is flat during this movement. Patient feels small pain in lower back during movement. *Lateral side left:* Small ROM. Lumbar and thoracic is flat. Stable pelvis. *Flexion:* The patient bends very slowly down and seems to be afraid during the movement. The lumbar spine is again flat. She tends to bend more to the right side and not straight down during the movement. Although, it is not a typical painful arch while bending.	**Dynamic tests of back:** *Backward bend:* The range of motion is small. The patient extends in both thoracic and lumbar spine. No pain during movement. *Lateral side left:* Small ROM. Lumbar spine is flat. Thoracic has a harmonic curve during movement. Stable pelvis. *Flexion:* We can see rounding during the bending and there is also small motion in the lumbar spine. There is no discomfort during the motion except from a "stretching" kind of pain in the bottom position. She is not able to reach the floor. She is bending straight downwards.

Examination of Breathing Pattern • Elevation of the upper rib cage, sternum and clavicles are noticed during inhalation. • She is using her abdominal muscles during exhalation • There is absence of lateral excursion of the lower ribs.	**Examination of Breathing Pattern** • Abdominal breathing during inhalation • Relaxes the pressure on the abdomen during exhalation • Slight pressure on the lateral border of lower ribs
Manual Muscle Testing Iliopsoas: L=1 R=1 Piriformis: L=1 R=1 Pectoralis major: L=1 R=1	**Manual Muscle Testing** Iliopsoas: L=0 R=0 Piriformis: L=1 R=0 Pectoralis major: L=0 R=0
Examination of fascial structures: **Thoracolumbar fascia:** Tight in both dorsal and caudal direction **Posterior fascial compartment of thigh (**Biceps femoris, semitentinosus, semimembrnosus)**:** Slightly pathological barrier in longitudinal axis	**Examination of fascial structures:** **Thoracolumbar fascia:** Physiologic barrier in caudal and cranial direction **Posterior fascial compartment of thigh (**Biceps femoris, semitentinosus, semimembrnosus)**:** Physiological barrier (slight restriction)
Examination of Basic Movement Patterns **Hip abduction:** Left foot - Physiological pattern Right foot – Altered pattern • Quadratus mechanism	**Examination of Basic Movement Patterns** **Hip abduction:** Left foot - Physiological pattern Right foot – Physiological pattern
Examination of muscle tone Quadratus Lumborum:	**Examination of muscle tone** Quadratus lumborum:

L = Hypertonic, TrP Diaphragma (costal part: L = Tension R= In tension Iliacus: L = Hypertonic R = Hypertonic Piriformis: L = Hypertonic R = Hypertonic	L = Slightly hypertonic Diaphragma (costal part): L = No tension R = No tension Iliacus: L = Normal R = Slightly hypertonic Piriformis L = Normal R = Slightly hypertonic

Table 19 Comparison of initial and final examination

The results above show that the applied therapy has been successful and beneficial for the patient. The therapy has been focused a lot on approaches for improving her posture. I think that the reason for her problems has been contributed due to this posture fault in both sitting and standing. There has also been a large focus on the patient´s breathing pattern, which I think also has a lot to do with her musculoskeletal dysbalance. During the practice I have learned the importance of rehabilitating breathing pattern dysfunction to aid in the rehabilitation and restoration of spine stability. I think a lot of her pain management also can be granted for this.

Prognosis

The patient will continue to come to the Monada Clinic for further rehabilitation twice a week for at least 2 weeks more. It will be important to continue to promote to self-management as much as possible as this is very effective for the treatment of low back pain. If the patient will continue to be active in her rehabilitation program and consider getting more physical exercise improving that will improve her fitness level she has good projections for her lower back problems and quality of life.

In addition to conditioning her back, she needs to condition her whole body. Physical activities such as walking or swimming can help strengthen her back. It will be necessary to plan and start a more rigorous exercise program after the pain is completely gone and she has a good understanding of the basic simple strength exercises. It is important that she begins slowly with the exercising. The future exercise program can include walking, bicycling, swimming together with strength

training and other aerobic exercise after what she prefers. She should avoid sports that may be dangerous to her back due to rough contact, twisting, sudden impact or direct stress like football, volleyball, high intensity weight lifting etc.

4 Conclusion

I was introduced to the patient on my 4th day of practice at the Monada Clinic. I chose her because she was the first patient that my supervisor had for the first visit during that week. With this in consideration I had the opportunity to follow her from the very first and acute phase and had therefor opportunity to see big improvements in a short period of time. We were able to cooperate well both because she spoke good English and she understood the exercises that I gave her well. I have used many of the therapeutic techniques that we have learned at school as well as some new approaches that my supervisor introduced me to.

When it comes to her prognosis the final kinesiologic examination reviews that she has had rapid improvements in both pain and disability only 10 days after started therapy. She is able to perform ADL in a better way then before with less pain.

It has been a great leaning experience to work with this particular diagnosis. I have received a lot of knowledge concerning the examination and therapy regarding the lumbar and also the thoracic spine and how posture, alignment, and breathing can affect the whole body. Having the bachelor practice at the clinic of Monada has given me the opportunity to work with a variety of different patients with diverse diagnosis affecting the lumbar and thoracic spine. Since low back pain has become such common health problem worldwide and a major cause of disability I am grateful that I have had the ability to experience numerous patients with this particular problem so that I can bring the knowledge and skills in my future practice.

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6 Supplement

6.1 List of tables:

6.2 List of figures

6.3 List of Abbreviations

F = Flexion

E = Extension

ABD = Abbduction

ADD = Adduction

ER = External rotation

IR = Internal rotation

LF = Lateral flexion

ADL = Activities of daily living

BMI = Body mass index

ROM = Range of motion

Ligg = Ligamentum

TrP = Trigger point

TLF = Toracolumbar fascia

IAP = Intraabdominal pressure

CNS = Central nervous system

6.4 Informed Consent form

INFORMOVANÝ SOUHLAS

V souladu se Zákonem o péci o zdravílidu (§ 23 odst. 2 zákona c.20/1966 Sb.) a Úmluvou o lidskýchprávech a biomedicíne c. 96/2001, Vás žádám o souhlas k vyšetrení a následné terapii. Dále Vás žádám o souhlas k nahlížení do Vaší dokumentace osobouzískávající zpusobilost k výkonu zdravotnického povolání v rámci praktické výuky a s uve□ejn□ním výsledku terapie v rámci bakalá□ské práce na FTVS UK. Osobní data v této studii nebudou uvedena.

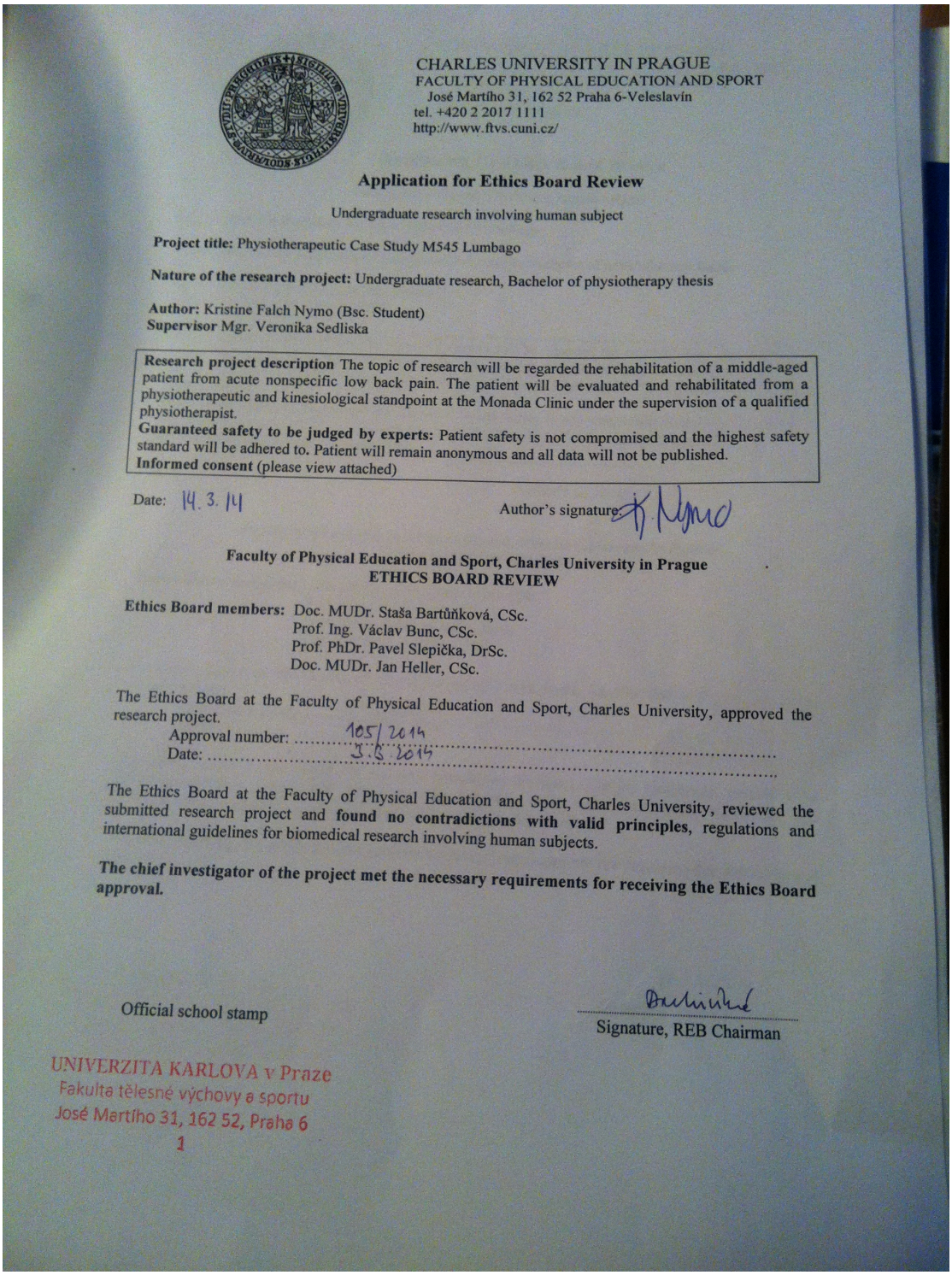
Dnešního dne jsem byla odborným pracovníkem pou□ena o plánovaném vyšetrení a následné terapii. Prohlašuji a svým dale uvedeným vlastnoru□ním podpisem potvrzuji, že odborný pracovník, který mi poskytl pou□ení, mi osobn□ vysv□tlilvše, co je obsahem tohoto písemného informovaného souhlasu, a m□la jsem možnost klást mu otázky, na které mi □ádn□ odpov□del.

Prohlašuji, že jsem shorauvedenému pou□ení pln□ porozum□la a výslovn□ souhlasím s provedením vyšetrení a následnou terapií. Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uve□ejn□ním výsledku terapie v rámci studie.

Datum:.....

Osoba, která provedla pou□ení:..... Podpis osoby, kteráprovedlapoucení:..... Vlastnoru□ní podpis pacienta /tky:.....

6.5 Approved application for Ethics Board



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Application for Ethics Board Review

Undergraduate research involving human subject

Project title: Physiotherapeutic Case Study M545 Lumbago

Nature of the research project: Undergraduate research, Bachelor of physiotherapy thesis

Author: Kristine Falch Nymo (Bsc. Student)
Supervisor Mgr. Veronika Sedliska

Research project description The topic of research will be regarded the rehabilitation of a middle-aged patient from acute nonspecific low back pain. The patient will be evaluated and rehabilitated from a physiotherapeutic and kinesiological standpoint at the Monada Clinic under the supervision of a qualified physiotherapist.
Guaranteed safety to be judged by experts: Patient safety is not compromised and the highest safety standard will be adhered to. Patient will remain anonymous and all data will not be published.
Informed consent (please view attached)

Date: 14. 3. 14 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: 105/2014
Date: 3.5.2014

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

Signature, REB Chairman

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1