CHARLES UNIVERSITY

Faculty of Physical Education and Sport UK

Department of Physiotherapy

Therapeutic approach of Chronic Low Back Pain

Bachelor thesis

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Prague, April 2007

Declaration

I declare that this Bachelor Thesis is based entirely on my own individual work. All information used is presented in the reference list at the end.

Pernille Eide

Acknowledgement

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Approval

I approve that Pernille Eide can use my personal information in her Bachelor thesis as long as it does not reveal my identity.
All pictures used, have to be unrecognizable.

Prague, 12.01.07

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CONTENTS

1. PREFACE

I was assigned a patient with diagnose chronic low back pain at my clinical work placement in Oddeleni rehabilitace a fyzikalni mediciny v Ustredni vojenske nemocnici. During two weeks practice, 08/01/2006 to 19/01/2006, I had 6 therapy sessions with the patient.

The main objectives are, first a general description of chronic low back pain, and secondly, an epicrisis including examination, treatment and efficacy of the patient.

2. GENERAL PART

2.1 Anatomy of the vertebral column

The vertebra column- extending from the skull to the apex of the coccyx- forms the skeleton of the neck and back and the main part of the axial skeleton. In an adult, the vertebral column typically consist of 33 vertebrae arranged in five regions: 7 cervical (neck), 12 thoracic (upper back), 5 lumbar (lower back), 5 sacral, and 4 coccygeal. The lumbosacral angle occurs at the junction of, and is formed by, the long axes of the lumbar region of the vertebral column and the sacrum. Motion occurs between only 24 vertebrae: 7 cervical, 12 thoracic, and 5 lumbar. The five sacral vertebrae are fused in adults to form the sacrum, and the four coccygeal vertebrae are fused to form the coccyx. [18]

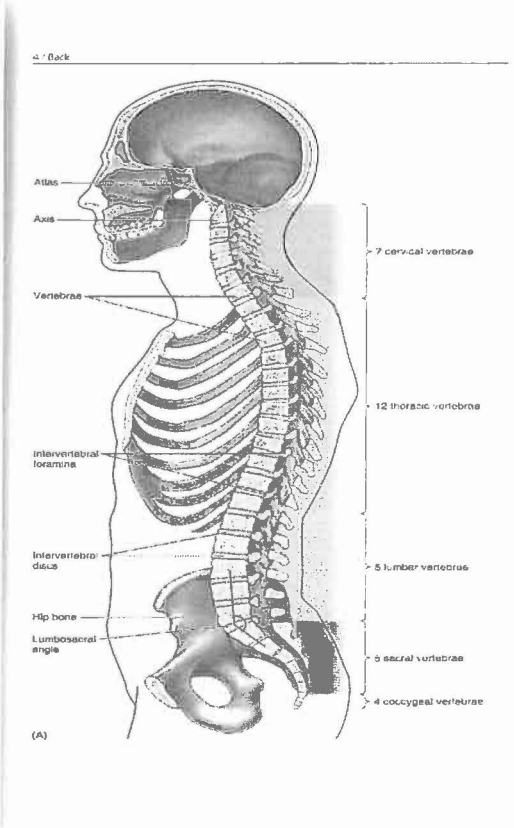

Fig. 2.1 Vertebral column. [18]

The vertebrae gradually become larger as the vertebral column descends to the sacrum, and then they become progressively smaller toward the apex of the coccyx. These structural differences are related to the fact that the successive vertebrae bear increasing amounts of the body's weight as the column descends, until it is transferred to the pelvic girdle at the sacroiliac joint.

In adults the vertebral column has four curvatures: cervical, thoracic, lumbar, and sacral. The curvatures provide a flexible support (shock-absorbing resilience) for the body. The thoracic and sacral (pelvis) curvatures are concave anteriorly, whereas the cervical and lumbar curvatures are concave posteriorly. [18][5]

The spinal cord may be described, for practical purposes, as consisting of columns of motor and sensory nerve cells, the grey matter, surrounded by ascending and descending tracts, the white matter. It lies within the vertebral canal and is protected by three surrounding fibrous membranes, the meninges. It is cushioned against trauma by the cerebrospinal fluid and is held in position by the denticulate ligaments on each side and the filum terminale inferiorly. The spinal cord is segmented, and paired posteriorly (sensory) and anterior (motor) roots corresponding to each segment of the cord leave the vertebral canal through the intervertebral foramina. The spinal cord is shorter than the vertebral column and terminates inferiorly in the adult at the level of the lower border of the first lumbar vertebrae. Nerve roots of the lumbar and sacral segments have to take an oblique course downward to reach their respective intervertebral foramina; the resulting leash of nerve roots forms the cauda equina. [21] [5]

Joint structure

Joints of the vertebral column include the:

- Atlantoaxial joints
- Atlanto-occipital joints
- Costovertebral joints
- Joints of the vertebral bodies

Are secondary cartilaginous joints (symphyses) designed for weightbearing and strength. The articulating surfaces of adjacent vertebrae are connected by IV (InterVertebral) discs and ligaments. [18] The IV discs is a cartilaginous structure with tough criss-crossing network of ligaments (annulus fibrosis) forming a protective ring around its gel-like fluid interior (nucleus pulposus), and provides strong attachments between the vertebral bodies and acts like shock absorbers. [15] The anterior longitudinal ligament is a strong, broad fibrous band that covers and connects the anterolateral aspects of the vertebral bodies and IV discs. This ligament maintains stability and prevents hyperextension of the vertebral column. The posterior longitudinal ligament is a much narrower, somewhat weaker band

that runs within the vertebral canal along the posterior aspect of the vertebral bodies. It prevents hyperflexion of the vertebral column and herniation of the discs. [18]

- Joints of the vertebral arches

  These joints are the zygapophysial joints, which are plane synovial joints between the superior and inferior articular processes. These joints permit gliding movements between the vertebrae. [18]

- Sacroiliac joints

  These articulations are strong, weightbearing synovial joints between ear-shaped auricular surfaces of the sacrum and ilium. The sacrum is suspended between the iliac bones and is firmly attached to them by interosseous and sacroiliac ligaments. The sacroiliac joints differ from most synovial joints in that they possess little mobility because of their role in transmitting the weight of most of the body to the hipbones. The sacrotuberous and sacrospinous ligaments, which join the sacrum to the ischium, allow only limited upward movement to the inferior end of sacrum, thereby providing resilience to the sacroiliac region when the vertebral column sustains sudden weight increases. [18]

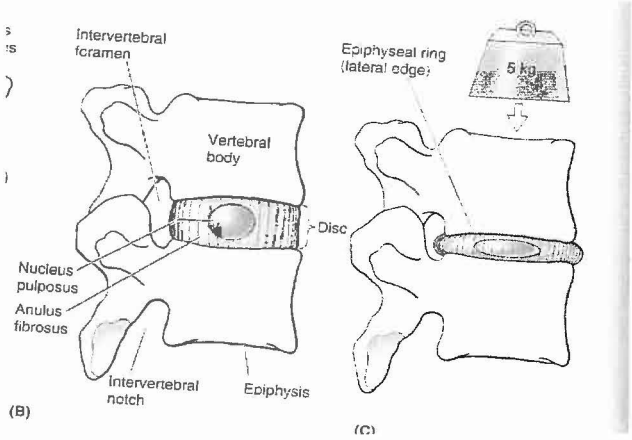

Fig.2.2 Structure of an intervertebral (IV) disc. [18]

2.1.1 Anatomy of the low back

The human lumbar spine, balanced on the pelvis by its muscles and ligaments, supports the whole length of the spine above it in the erect posture. The human lumbar spine is unique in its fully erect posture. The thoracic spine maintains its primary kyphosis but the lumbar spine develops a lordosis on adoption of upright posture in infancy; this lordotic posture is generally maintained throughout life. In erect column, the lowest parts bear the highest load. This is reflected in the large size of the lumbar vertebrae and in the thickness and high proteoglycan content of lumbar intervertebral discs. In addition, the lumbar spine has wide ranges of flexion, extension, and lateral bending. There are variations in the structure and function of the spine according to familial characteristics, age, gender, and life-style influences on wear and tear. [25]

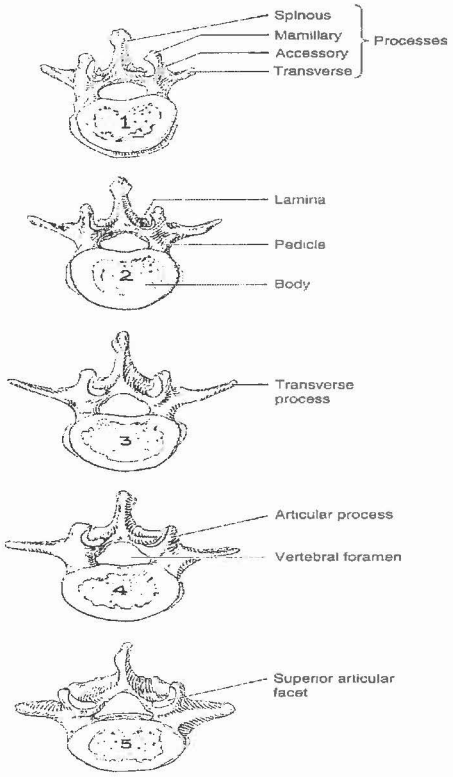

Fig. 2.3 Lumbar vertebrae [18]

L5 is the largest of all the movable vertebrae; it carries the weight of the whole upper body. Its massive body and transverse processes characterize L5. Its body is markedly deeper anteriorly; therefore, it is largely responsible for the lumbosacral angle between the long axis of the lumbar region of the vertebral column and that of the sacrum. Body weight is transmitted from L5 vertebrae to the base of the sacrum, formed by the superior surface of the S1 vertebrae. The hatchet-shaped spinous processes of lumbar vertebrae are thick and broad and point posteriorly.

The articulate processes of lumbar vertebrae facilitate flexion, extension, and lateral flexion of the vertebral column; however, the prohibit rotation. [18][5]

Muscles of low back

Each of the lumbar back muscles is capable of several possible actions. No action is unique to a muscle, and no muscle has a single action. Instead, the back muscles provide a pool of possible actions that may be recruited to suit the needs of the vertebral column.

There are three groups of muscles in the back.

- The superficial and intermediate groups include extrinsic back muscles that produce and control limb and respiratory movements, respectively.
- The deep group includes the true or intrinsic back muscles that specially act on the vertebral column, producing its movement and maintaining posture. [18]

Muscle	E.	F.	L.F	R.
m. Erector spinae	B.L		U.L	
m. Transversospinal	Ass.			Ass.
m. Interspinalis	Ass.			Ass.
m. Intertransversarii			Ass.	
m. Levatores costarum			Ass.	

Tab. 2.1. Deep or intrinsic muscles back muscles. E=extension, F=flexion, L.F=lateral flexion, R=rotation, B.L=bilateral, U.L=unilateral, Ass= assisting. [18]

Muscle	E.	F.	L.F.	R.
m. Rectus abdominis		B.L		
m. Psoas major		B.L		
m. Erector spinae	B.L		U.L	
m. Multifidus	B.L		U.L	U.L
m. Semispinalis thoracic	B.L			
m. Iliocostalis thoracis and lumborum			U.L	
m. Longissimus thoracic			U.L	
m. External oblique		B.L	U.L	U.L*
m. Internal oblique		B.L	U.L	U.L*
m. Quadratus lumborum	B.L		U.L	

Muscle	E.	F.	L.F	R.
m. Rotatores				U.L
m. Semispinalis thoracis				U.L

Tab. 2.2 Principal muscles producing movements of thoracic and lumbar intervertebral joints, and superficial and intermediate back muscles. E=extension, F=flexion, L.F=lateral flexion, R=rotation. B.L=bilateral, U.L=unilateral, U.L*= unilateral acting synchronously with opposite internal/external oblique. [18][6][14]

2.1.2 Functional anatomy of the low back

The low back, or lumbar area, serves a number of important functions for the human body. [17] When we are upright, the lumbar spine bears the comprehensive weight of the body above it, transmits this weight to the pelvis when sitting and to the feet during standing, walking, and running. [16] During bending, extension or rotation at the waist, the lower back is involved in the movement. Therefore, injury to the lumbar structures often can be detected when the body is standing erect, or used in various movements. [17]
Protecting the soft tissues of the nervous system and spinal cord as well as adjacent organs of the pelvis and abdomen is a critical function the lumbar spine and its adjacent muscles. [17]

The movements possible at each lumbar segment are traditionally described as being in the sagittal (flexion-extension), coronal (lateral flexion), and horizontal (axial rotation) planes. Each movement occurs along one of three coordinate axes, x, y, and z. Thus, all mobile segments of the lumbar spine possess 6 degree of freedom, and each movement consists of an angular or rotary displacement together with translation of a vertebra on its subjacent vertebrae. [25]
Because many ligaments connect every pair of adjacent vertebrae, only limited motion is possible in any one intervertebral joint. However, the sum of all the movements in the many vertebral articulations results in significant mobility in the spinal column and trunk as whole. This mobility varies considerably between individuals. [1]

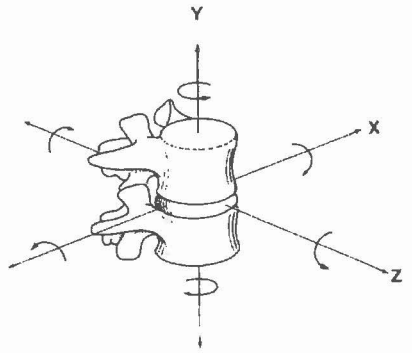

Fig. 2.4 Planes and axes movement [25]

Published studies of lumbar spinal movement estimated the range of sagittal motion of the lumbar region vary widely from 121 degrees in a young male acrobat, to 21,8 degrees in elderly woman. However, Begg and Falconer considered 70 degrees to be the "normal" average total range of lumbar flexion-extension. [25]

Major active movements

As the spine bends forward, there is an increase in the activity of the back muscles, and this increase is proportional to the angle of flexion and the size of any load carried. The movement of flexion is produced by gravity, but the extent and the rate at which it proceeds is controlled by the eccentric contraction of the back muscles. At a certain point during flexion, the activity in the back muscles ceases, and the vertebral column is braced by locking of the zygapophysial joints and tendons in its posterior ligaments. This phenomenon is known as "critical point". When it does occur, it does so when the spine has reached about 90% maximum flexion, even though at this stage the hip flexion that occurs in forward bending is still only 60% complete. The significance of critical point is that it marks the transition of spinal loadbearing from muscles to the ligamentous system.

Extension of the trunk from flexed position is characterized by high levels of back muscle activity. The lumbar vertebrae are rotated backward principally by the lumbar multifidus, causing their superior surfaces to be progressively tilted to upward to support the rising thorax. (25)

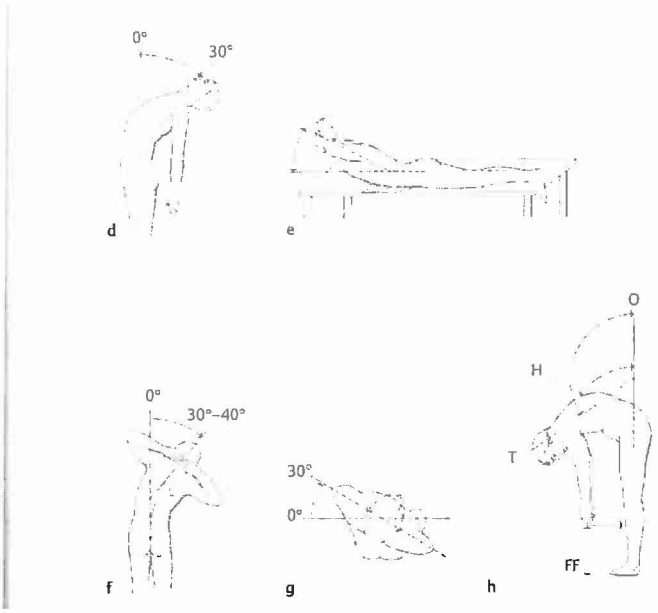

Fig. 2.5 1d-h, **d-e** Backward bending (extension) of the spine: standing (**d**) and prone (**e**). **f** Lateral bending of the spine. **g** Rotation of the trunk. **h** Forward bending of entire spine: H flexion in hip, T total excursion, FF distance between fingers and floor.[1]

2.2 Chronic low back pain

Backache is a non-specific term used to describe back pain. More than 80% of people have back complaints during their lifetime. [2] Low back pain is diagnosed as chronic LBP when the pain and symptoms lasts for a longer time than 3 months. [10]

2.2.1 Prevalence

The overall prevalence of back pain remains around 80% with an annual incidence of 5%. The number of people disabled by back pain between 1971 and 1981 increased by 168% (14 times more than the population growth). The annual costs associated with back pain in the United States are estimated to be in excess of 50 -billion dollars. [15]

Back pain is very common in adults. About two-thirds of adults have LBP at some point in their lives.

- Low back pain is age-related. It generally begins to affect people in their 30s to 50s.
- LBP is the most common cause of limited activity in people younger than 45. (It can also cause disability in people older than 45).
- LBP is not common before adolescence, although spinal injuries can occur.
- LBP may be more common in men and in those who:
    - Smoke

- Frequently lift heavy objects or children
- Are in poor physical condition

- LBP may be more likely in people who:
  - Are under mental stress
  - Have another chronic pain.
  - Are not satisfied with their job.

Fortunately, 90% of people with low back pain recover within 6 weeks, and 95% recover within 12 weeks. Over 98% recover within 1 year. [7]

2.2.2 Symptoms of low back pain

Depending on the cause, low back pain can cause a range of symptoms. It may:

- Be dull, burning, or sharp.
- Be felt at a single point or over a broad area.
- Come on gradually or suddenly.
- Occur with muscle spasms or stiffness.
- Cause leg symptoms, such as pain, numbness, or tingling, often extending below the knee. These symptoms can occur on their own or along with low back pain. Leg symptoms are often caused by lower spine problems that place pressure on a nerve that leads to the leg.

A rare but serious problem called cauda equina syndrome can occur if the nerves at the end of the spinal cord are squeezed. The symptoms are weakness or numbness in both legs, along with loss of bladder or bowel control. [10]

2.2.3 Pain patterns of lumbar spine

Somatic referred pain, radicular pain and combined states are typically pain patterns for lumbar spine.

Pain pattern	Pain location	Type of pain	Source of pain	Frequency
Somatic referred	Pain received in regions innervated by nerves other than those that innervate the actual source of pain.	Deeply, dull and aching quality. Hard to localize. Relatively fixed position.	Any structure of lumbar spine; dura mater, muscles, ligaments, zygapophysial and sacroiliac joints, and intervertebral discs.	Far more common than radicular pain.
Radicular	Narrow band, few centimetres wide, along the length of lower limb. Linear distribution.	Electric or lancinating. Travelling or shooting along the length of lower limb. And/or paresthesia in distal part of dermatome.	Neuralgic; nerve root compression.	Fewer than 12% of patient presenting with lumbar disorder.
Combined state	Constant location of somatic pain, and linear radiating of radicular pain.	Deep and aching of somatic and electric shooting of radicular pain.	Radicular pain superimposed on a background of somatic pain.	Not specified.

Tab. 2.3. Pain patterns of lumbar spine. [25]

The reason for distinguishing somatic referred pain from radicular pain in combined states is so that miscomprehension about treatment does not arise. Treatment that may benefit radicular pain might not be appropriate for somatic pain, and vice versa. [25]

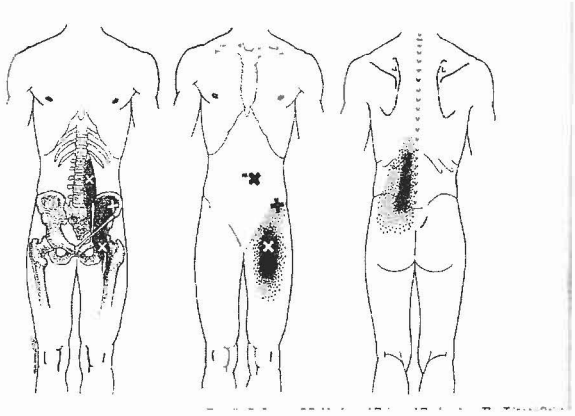

Fig. 2.6 Referred pain from iliopsoas muscle [15]

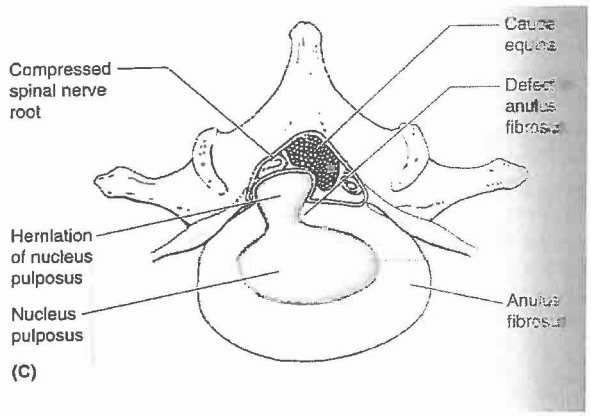

Fig. 2.7 Herniation of nucleus pulposus into the vertebral canal [18]

2.2.4 Cause of chronic low back pain

It was once believed that draughts, chills, or the weather caused low back pain. Today the understanding is better, and it is generally agreed by specialists that most backache is caused by mechanical strains.

The most common causes of low back pain are:

- Injury or overuse of muscles, ligaments, facet joints, and the sacroiliac joints. Mechanical strains often occur in:

  - Postural stress

- Postural neglect
- Prolonged incorrect sitting
- Incorrect lifting
- Environmental factors
- Working positions
- Coughing and sneezing [16]

- Pressure on nerve roots in the spinal canal. Nerve root compression can be caused by:
    - A herniated disc, often brought on by repeated vibration or motion (as during machine use or sport activity, or when lifting improperly), or by a sudden heavy strain or increased pressure to the lower back.
    - Osteoarthritis (joint degeneration), which typically develops with age. When osteoarthritis affects the small facet joints in the spine, it can lead to back pain.
    - Spondylolysis and spondylolisthesis , vertebra defects that can allow a vertebra to slide over another when aggravated by certain activities.
    - Spinal stenosis, or narrowing of the spinal canal, which typically develops with age.
    - Fractures of the vertebrae caused by significant force, such as from an auto or bicycle accident, a direct blow to the spine, or compressing the spine by falling onto the buttocks or head.
    - Spinal deformities, including curvature problems such as severe scoliosis or kyphosis.
- Compression fractures. Are more common among postmenopausal women with osteoporosis, or in men or women after long-term corticosteroid use. In a person with osteopososis, even a small amount of force put on the spine, as from a sneeze, may cause a compression fracture. [8]

Less common spinal conditions that can cause low back pain include:

- Ankylosing spondylitis, which is a form of joint inflammation (arthritis) that most often affects the spine.
- Bacterial infection. Bacteria are usually carried to the spine through the bloodstream from an infection somewhere else in the body or from IV drug use. But bacteria can enter the spine directly during surgery or injection treatments, or as the result of injury. Back pain may be the result of an infection in the bone (osteomyelitis) or in the spinal cord (most often in the material covering the spinal cord, called an epidural infection).

- Spinal tumors, or growths that develop on the bones and ligaments of the spine, on the spinal cord, or on nerve roots.
- Paget's disease, which causes abnormal bone growth most often affecting the pelvis, spine, skull, chest, and legs.
- Sheuermann's disease, in which one or more of the bones of the spine (vertebrae) develop wedge-shaped deformities. This causes curvature of the spine (rounding of the back, or kyphosis), most commonly in the chest region. [8]

Other medical conditions that can cause pain that may be similar to low back pain include:

- Pelvic inflammatory disease.
- Aortic aneurysm.
- Peptic ulcers.
- Gallbladder disease.
- Pancreatitis.
- Urinary disorders such as kidney stones or urinary tract infections.
- Prostate disease. [8]

2.3 Physical examination

2.3.1 Inspection

- During recording of anamnesis the PT should observe the patient. Attitude, movements, posture, speech, breathing pattern are some of what should be noted. If possible, should the PT draw a temporary conclusion of patient's status presence.
- General posture noted in frontal, lateral and posterior view. Important for inspection of spine are in e.g. levels of the shoulders, comparison of both shoulder blades, level of iliac crest, lateral pelvic obliquity, vertical alignment for the spine- any deviation of the vertical. Profile of the back- kyphosis or lordosis deformity, or absence of physiologic kyphosis and/or lordosis. The body parts that influence the spine should also be inspected, e.g. feet (position, contour and any abnormalities), extremities, and neck. [1]
- Breathing examination to determine the breathing pattern. [24]

2.3.2 Palpation

- Palpation examination and barrier phenomenon of skin, muscle fascia, and muscle mass, will give information about possible hyperalgesic skin zones (HAZ), tender and trigger points, restriction of fascia mobility, muscle spasm, hyper-tonicity or hypo-tonicity. [1] [23]
- By Kibler Fold test the consistency of the skin fold (rubbery or edematous), and any lack in the skin mobility. In areas of hypalgesia, the skin is less pliable, more difficult to raise, and resists rolling. The patient reports pain. [1]
- Skin perspiration and turgur is also palpable. In most cases it indicates a reflex change. [13]
- Palpation of active trigger points results in pain and causes referred pain in characteristic pain patterns. Latent trigger points are far more common and is only felt as tenderness. These latent TRP can become active through a number of circumstances. [6]
- Pelvis palpation- levels of iliac crests, ASIS, PSIS, ischial tuberosities for determining torsion, anterior/posterior tilt, lateral shifting. [1] [5]
- Breathing examination in combination with palpation and observation is of great importance. It is known that the neck has a central role for the balance and equilibrium of the body and effect on the postural muscles and the movement patterns of the body as a whole. Great reduced movements in the neck, thoracic column, and jaw, also recognized by tension in back, neck-jaw-throat region, causes degenerative changes in column and affects the balance and breathing pattern in a poor manner. [24]

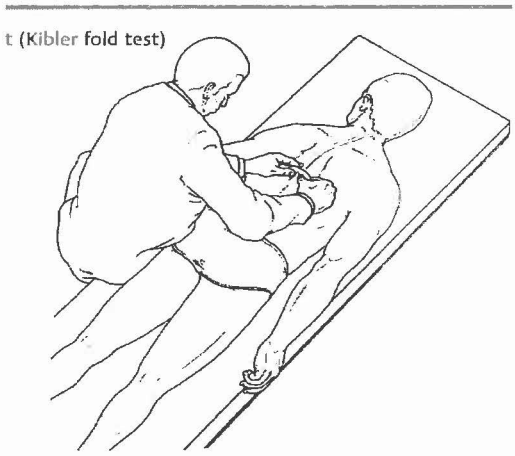

Fig. 2.8 Skin-rolling test (Kibler fold test) [1]

2.3.3 Functional tests

1. ROM: the effects of movement and position on the behaviour of pain, the painful or painfree range, and the effects of repeated testing should be determined. Should be performed both active and passive.

   Testing of ROM of muscles of back, hip, lower extremities, and neck should be measured either by goniometry, specific functional tests, or by a sensor. Range of muscle length (shortness) may also be expressed according Janda. Muscles that are excessive in length are usually weak and allow adaptive shortening of opposing muscles; muscles that are too short are usually strong, and maintain opposing muscles in a lengthened position. During radicular pain the mobility in spine is severely limited, and there is a significant tension in the lumbar musculature.

   Different functional tests- Ott sign for thoracic spine, Schober sign for lumbar spine, Stilbor's distance for thoracic and lumbar spine, Flesch de Forestier sign for cervical spine, and Thomayer's distance for whole spine (also known as fingertips-to-floor distance). [12] [1]

2. Anthropometrical measurements of the lower extremities to detect any hypotrophy caused by weakness due to radicular pain or any difference in length of the extremities that may cause not optimal postion of the pelvis and spine. [1] [12]

3. Gait examination; determine walking pattern, weight load, synkinesis of trunk, and detect any abnormalities. Possible to perform with closed eyes or do backwards walking to detect balance or for general testing. [12]

4. Manual muscle testing; the determination of the subject's ability to contract muscle groups voluntarily. During testing, substitution of a muscle or muscle group, determination of a nerve root level, and subtle weakness of a myotom are among findings. Grading of manual muscle testing has a scale (According Key to Muscle grading by Kendall) from 0 to 5. 0-zero grade (no evidence of any contraction); 1-trace grade (feeble contraction); 2-poor grade; 3-fair grade (hold position against gravity); 4-good grade (hold test position against moderate pressure; 5-normal grade (hold test position against strong pressure). [12] [19] [14]

5. Neurological examination; reveals if there is radicular pain, pseudoradicular pain, or if the low back pain is somatic referred.
   - Tendon reflexes- if intact, integrity of the following is confirmed: cutaneous innervation, motor supply, and cortical input to the corresponding spinal segment.

Several systems for reflex grading exists, however, most common is to compare the same tendon reflex of each body half.

Biceps brachii C5, 6

Brachioradialis C6

Triceps C6, 7

Patella L2, 3, 4

Achillies S1

-- Pathological reflexes like Babinsky, Chaddock reflex, Rossolimo and Oppenheim. (19) (26) (22)

- Subjective light touch; fingers lightly stroking on both sides simultaneously along dermatomes- testing several areas- ask if patient feels if there is a difference in the sensation from both sides. If differentiation is felt, most likely lack of cutaneous innervation. (19)

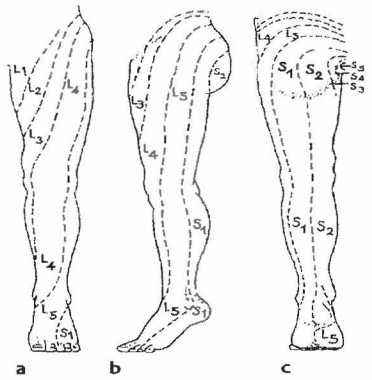

Fig. 2.9 Dermatomes of the lumbar and sacral plexuses according to Herlin. (1)

- Position sense- patient has closed eyes, PT places a body part in a position and patient places other body part in same position. (Proprioceptor testing). (19) (26)
- Lasegue sign (straight leg raising test)- indicates nerve root irritation. The angle achieved when lifting the leg is estimated in degrees. Increases in sciatica pain by raising the head (Kernig sign) and /or passive dorsiflexion of the great toes (Turyn sign) are further signs of significant sciatic nerve irritation. Sacral or lumbar pain that only increases slowly as the leg is raised is usually attributable to degenerative joint disease (facet syndrome), irritation of the pelvic ligaments (tendonitis), or increased tension in the hamstrings (indicated by a soft endpoint). It is important to distinguish this "pseudoradicular" pain, (pseudo- Lasegue sign) from genuine sciatica, (true Lasegue sign.) (1)

- Contralateral Lasegue sign- indicates nerve irritation. Lifting the healthy leg in prone position. Positive if the raise of healthy leg causes sciatica on the other, affected leg. (1)
- Bragard test- indicates nerve root compression syndrome, differentiating a genuine Lasegue sign from a pseudo-Lasegue sign. A positive Bragard sign is evidence of nerve root compression, which may lie between L4 and S1. Dull, non-specific pain in posterior thigh radiating to the knee is attributable to stretching of the hamstrings and should not be assessed as a Lasegue sign. (1)
- Lasegue differential test- differentiates sciatica from a hip disorder. Performed as Lasegue test only when reaching the painful point the PT bends patients knee. In a patient with sciatic nerve irritation, flexing the knee will significantly reduce symptoms. Where a hip disorder is present, the pain will remain and may even be exacerbated by increasing flexion in the hip. (1) (26)
- Tiptoe and heel walking test; identifies and assesses a nerve root disorder in the lumbar spine. Difficulty or inability to stand or walk on tiptoe suggests a lesion of the S1 nerve root; difficulty or inability to stand or walk on the heels suggests a lesion of the L4-L5 nerve root. (1)
- Reverse Lasegue test (Femoral nerve Lasegue test); indicates nerve root irritation due to the hyperextension of the hip in prone position with flexed knee places traction on the femoral nerve. (1)

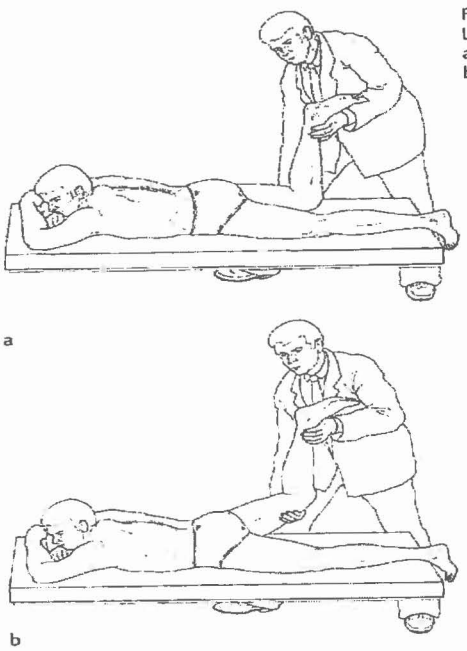

Fig. 63a, b Reverse Lasègue test:
a starting position,
b hip hyperextended

Fig. 2.10 Reverse Lasegue test (1)

6. Basic movement patterns:

Gives overall information about the movement quality of the particular subject. In relation to low back pain examination of hip (hyper) extension, hip abduction, curl up, neck flexion, shoulder abduction and push up are of importance. The result may indicate lower crossed syndrome. [22] [15]

7. Functional tests for the lumbar spine:

- Adams forward bend test; assesses structural or functional scoliosis. Patient is sitting or standing and bends forward. If the detectable scoliosis improves during flexion, it is a functional scoliosis; where the scoliotic deformity remains the condition is true scoliosis with structural changes. [1]
- Prone knee flexion test; differentiates lumbar pain from iliosacral pain. Patient is prone; the PT flexes the knee and attempts to bring the heel as close to the buttocks as possible. During the test, the patient will initially feel tension in the sacroiliac joint, then lumbosacral junction, and finally in the lumbar spine. This pain pattern without radiating radicular pain suggests degenerative changes and/or ligamentous insufficiency. Increasing radicular pain is a sign of disk pathology. [1]
- Psoas sign; diagnostic assessment of lumbar pain. Patient is in supine position and raises one leg with knee extended. PT then suddenly presses on the anterior aspect of the thigh. Patient will report pain in the presence of changes in lumbar spine (spondylarthritis, spondylitis, or disk herniation) or in the sacroiliac joint. [1]
- Lasegue drop test- differentiates lumbar pain. [1]
- Hyperextension test- indicates a lumbar spine syndrome. [1]

8. Manual therapy; Joint play is according Mr. Mennell definition a translator movement which can be performed passively. When it is absent the functional movement is impaired. All joints in the spinal column (each individual segment) and joint play of the sacroiliac joint should be examined. In relation to body posture and weight carrying the joint play of the feet should also be examined. If scoliosis is present the joint play examination of the ribs is in order. [11]

2.3.4 Radiographic examination

Radiographic evaluation is equally essential for the assessment of spinal statics at the base of the spinal column as for the assessment of correction.

X-ray; is an examination of the skeleton, useful to detect any structural deviation such as scoliosis, fractures, dislocations, flattening of spine, kyphosis, lordosis and osteoporosis. The position of feet must be held constant, in the anteroposterior view, they should be symmetric to a line on the floor corresponding to the centre of the x-ray screen. In the side view, the feet should be placed on the same line at the site of the outer ankle.

CT or MRI scan is needed to demonstrate spinal nerve roots and identify disk protrusion. MRI detects also soft-tissue damage, tumor or infection. It has also the advantage of not using ionising radiation that the CT scan does. [3] [15] [4]

2.3.5 Treatment

Always treat the primary cause with main aim on the general coordination. This may involve also treatment of the secondary symptoms (muscle spasm, joint blockages etc) but the main aim is the primary cause and the correction of the functional abnormal position of the segment. [15]

Exercise and back pain

Bed rest and analgesics remain the treatments prescribed by most physicians in the management of LBP. This is in spite of the lack of evidence that prolonged bed rest or the avoidance of movement and exercise brings about a reduction in back pain. Indeed, current research shows that, apart from a brief period of rest immediately after the onset of acute LBP, bed rest has no effect on the natural history of back pain. Similarly, if the literature on the use of physical activity is considered, it is clear that well designed exercise and movement programs play an important role in the treatment of musculoskeletal disorders, including the most acute and chronic LBP syndromes, and are essential in the restoration of function necessary to maintain the productivity. [25]

Structural versus functional pathology

A short survey of the main characteristics of dysfunction as contrasted with structural pathology may be useful to demonstrate the fundamental difference in approach.

1. First step is to decide whether the problem described by the patient results mainly from dysfunction or from structural pathology.

2. A structural lesion frequently causes dysfunction that then produces the clinical manifestations; on the other hand, dysfunction by itself may cause clinical manifestations.
3. The reversibility of dysfunction makes immediate cure a possibility, whereas structural pathologic change requires healing.
4. The aim of structural diagnosis is to localize and determine the nature of the lesion; in dysfunction, it is essential to investigate correlations and interplay, i.e., the chain reactions.
5. Structural diagnosis aims at the organ at fault, functional diagnosis at the organism as a whole.
6. The aim of therapy of pathological change involving a structure is healing or excision; in dysfunction, it is to treat the relevant link of the chain.
7. Methods and techniques of "alternative" or "complementary" medicine are relevant mainly in disturbance of function. [15]

Rehabilitation versus Conservative Treatment

Rehabilitation is different from acute, conservative care. Conservative care is ideal for acute disorders. It focuses on the injured part, pain control, and promotion of soft tissue healing. Rehabilitation is concerned with restoring musculoskeletal function in patients with subacute, chronic, and recurrent conditions. Rehabilitation attempts to prevent or manage disability through functional restoration, work hardening, and psychosocial intervention. The key difference between rehabilitation and traditional conservative care is the primary emphasis on function rather than pain relief. Patients are educated that pain perception will decrease as physical functioning improves. This focus transforms the patient from a passive, dependent recipient of care to an active participant engaged in the process of rehabilitation. Rehabilitation involves lifestyle changes and behavioural re-education (functional restoration), and thus is part of a biopsychosocial approach. The patient's suffering and illness are more important than a specific disease process. [15]

Rehabilitation for chronic back pain

- Trigger point therapy for TRP- post isometric relaxation for latent and active TRP [6]
- Correction of muscle dysfunction- disturbed body statics (seen in postural examination), asymmetric muscle balance; strengthening of weak muscles- stretching of short muscles which also results in improved strength of inhibited

antagonistic muscles, probably mediated via the Sherrington's law of reciprocal innervation. Typical pattern in chronic LBP; tightness of the hip flexors and spinal erectors and inhibition and weakness of the gluteal and abdominal muscles. (15)

- Manual therapy included mobilization, method of choice for treatment of pain or restoring movement in a hypo-mobile joint, manipulation treatment of choice when an intervertebral joint is locked and traction which in the lumbar spine affect joints only minimally, but it is specific in the treatment of disk lesions. Manipulative therapies must be painless, and if possible, to give immediate relief. (25) (15) (11)
- The McKenzie approach for chronic LBP has shown in a study comparing four rehabilitation programs, conducted by the New Zealand Accident Compensation Corporation, that the institute program was successful in restoring 63% of the patients to workability. The McKenzie approach consists of seven exercises performed actively by the patient. (25) (16)
- Back school program- teaching back pain prevention and self-care. Patient education of Brugger position, correct lifting technique, technique of getting out of bed. (15)
- Electrotherapy- used in the treatment of pain. Often applied are Diadynamics (long period), middle frequency types (TENS, Traberts), and ultrasound. (20) (2)

Medicine for chronic low back pain

There are no medicines that have been proven to reliably decrease chronic back pain, but several medicines are likely to be beneficial. These include:

- Painkillers (acetaminophen,opiates) .
- Nonsteroidal anti-inflammatory drugs (NSAIDs).
- Anesthetic or corticosteroid injections.

Antidepressants (such astricyclis), muscle relaxant, epidural corticosteroids injections, and anticonvulsant have all been prescribed for chronic low back pain, but they have not been researched enough to know whether they are effective for most people.

There are people having facet joint injections of anaesthetic or corticosteroid for low back pain, but research has shown this to be ineffective or even harmful. (9)

Surgical treatment

Operations have no place in the management of recurrent back strain. Indications for spinal operations:

- Disc excision for proven disc with neurological signs.
- Instability caused by spondylolisthesis or unstable discs.
- Severe scoliosis, kyphosis, and other spinal deformities.
- Some tumors and infections.

Operative treatment for prolapsed disc is considered if there are the following indications:

1. No improvement in the symptoms and signs after 6 weeks rest.
2. An increase in the neurological deficit.
3. Bladder or bowel involvement suggesting a cauda equina lesion.
4. Intractable pain.

If operation is considered, a CT or MRI scan is needed to demonstrate spinal nerve roots and identify the disk protrusion. If the site of the disk protrusion matches the clinical signs, the disk can either be softened by chymopapaine injection or excised surgically. [3]

Alternative methods

- Lumbosacral brace- if patient with pain insists on returning to work before full movement has returned, a lumbosacral brace will lessen the risk of recurrence. [3]
- Acupuncture- the traditional Chinese practice of therapy and pain relief using needles. [20]

3. SPECIFIC PART

3.1 Personal data

Patient visited MUDr. Robert Valka 02.01. 2007 and was prescribed 6 therapy sessions in the two following weeks.

Initials: C.C

Gender: Female.

Nationality: Philippines- came to Prague in 2002.

Date of birth: 1973

Diagnosis: Chronic low back pain.

3.2 Anamnesis

Family anamnesis:

Healthy parents, no other specifics than one aunt in Germany with low back pain.

Personal anamnesis:

- Normal childhood diseases
- No surgeries
- No injuries
- No allergies
- Abuses anamnesis; rarely alcohol, no smoker.
- Pharmacology anamnesis; takes Coxtral (analgesics) when needed before bed, if pain in stomach- Helicid.
- Other diseases/injuries; speculation of Ascites months ago. Performed U.S – negative.
- Has a fat-free diet.

Occupational anamnesis:

Works in the Spanish residence in Prague, where she has worked since 2002. There she has a multitask work type, e.g. cleaning, changing beddings, answering phones. Most of the work demands full body activity with lifting and carrying.

Social anamnesis:

Patient lives in the Spanish residence with her companion and they have one child.
No activities outside job and no hobbies.

Medical history:

The onset of the low back pain started 5 years ago when patient moved to The Czech Republic. During wintertime and menstruation the pain is worse and up to three weeks before consultation with the doctor she felt radiating pain down her left leg. This pain was not constant and was completely gone by 02.01.2007. Patient also has a history of pain in the knees last year, but has not felt the pain since early 2006.

Diagnosis according MUDr. Robert Valka 02.01.2007:

- Chronic low back pain.
- Sinister convex sacrolumbar scoliosis seen on X-ray
- Neurological examination- physiologic, except for non-specific paresthesia of left lower extremity.
- Hyperlordosis of lumbar spine.
- No springing movement in left sacroiliac joint.
- Pain during flexion and retro-flexion of trunk.

Recommended therapy:

- 6 sessions of Physical Therapy.
- Electrotherapy- interferential current, 80+20 Hz after each physical therapy session.

Previous rehabilitation:

In 2003 patient had 5 sessions of physical therapy at Dejvicka. Patient felt less pain for a short while until the pain returned two weeks after last therapy in 2003.

Status present:

Height: 156 cm, weight: 65 kg, BMI: 26,0- overweight.
Patient is right-handed.
She feels local, deep pain in the low back, a little more to the left side. During cold weather and menstruation the pain is worse, and applying hot water bottle the pain reduces. Patient feels no pain in the stomach, but is determined to continue on the fat-free diet.

Differential diagnosis:

Based on the anamnesis the primary problem is the pain in the low back, with a tendency to be felt more on left side. The X-ray showed sinister scoliosis of sacro-lumbar part, however, due to the personal information given, it is more likely to believe that the pain results from a functional problem. There is no radicular pain present and therefore no reason to believe this to be pathology of the neurology in the spine. The U.S gave no indications of Ascites, and the patient is not diagnosed, however, the patient wants an endoscopy examination. The Doctor has not been informed of her wish. The patient has a demanding job, and gives an impression of stress and guilt for taking time off work, to go to the therapy sessions.

3.3. Initial kinesiologic examination.

3.3.1 Postural examination by inspection

Posterior view*:

Heel shape and loading	Symmetrical round, minimal load on both sides.
Feet and loading	Right foot in external rotation and medial load on both feet.
Calf- shape and size	Right calf increased concavity on superior fibula side, symmetrical lateral part.
Popliteal lines	Right line higher
Thigh contour and size	Adducted thighs- not able to detect medial line, symmetrical size
Sub-gluteal lines	Right gluteal line higher and less marked
Tiles	Increased concavity on left side
Back, curvatures, trophicity of paravertebral muscles.	Hyperlordosis of lumbar spine, hypertrophy of erector spine in left upper lumbar spine and lower thoracic spine.
Inferior angle of scapula	Left higher.
Scapula position	Abduction of both, increased in left.
Shoulder position	Left higher.
Trunk	Positive rotation.
Earlobes	Left higher

Arms	Symmetric pronation, adduction and semi flexion.

Tab. 3.1. Posterior postural examination. *See supplement Fig.7.1.

General note: Adducted standing with titubation. Seemed tight and tensed.

Lateral view**:

Feet	Pes planus- flat transversal and longitudinal arch- symmetrical on both sides. Forward weightbearing.
Knees	Hyperextension of both.
Pelvis	Anterversion
Spine curvature	Hyperlordosis of lumbar spine, flat thoracic spine and hyperlordosis of cervical spine.
Abdomen	Prominent
Shoulders	Left is protruded.
Chest	Sunken
Arms	In anterior fixed position
Head	Forward head posture.

Tab.3.2. Lateral postural examination. **See supplement Fig.7.2.

General note: Stooped posture with titubation. Pelvis drawn forward to feet, shoulder drawn forward in relation to pelvis and head thrust forward.

Anterior view:

Feet- arches	Flat transversal and longitudinal arches (Pes Planus) ***. External rotation of right foot.
Loading	Medial loading of both feet, curled and very loaded toes in both feet. ***
Patella	Symmetrical.
Knee	Valgosity of knees, dark spots on both knees from sun exposure.

Thigh	Unable to detect medial side- lateral side symmetrical.
Navel	Deviated caudal and slightly to the right.
Tile	Left increased concavity.
Trunk	Positive rotation
Clavicle	Left higher
Shoulder	Left higher
Arm	Left arm increased flexion in shoulder.
Head	Small lateral flexion to the right

Tab.3.3. Anterior postural examination. *** See supplement: Fig. 7.3.

Breathing observation:

During the static postural examination the patient had only visible chest breathing, which seemed superficial with very little movement.

Conclusion of postural examination:

According the X-ray examination the patient has sinister convex sacrolumbar scoliosis, however, this was not detectable during static postural examination. Patient has a stooped lordotic and slumped posture. This can be concluded from the curled, white toes and the reference lines for the assessment of body statics, typically pelvis in relation to feet, shoulder in relation to pelvis, and the head thrust forward. As for the slumped posture, the prominent abdomen, hyperlordosis of the lumbar spine, and the forward head posture, are typical signs. (Typically with anterior pelvic tilt, the low back arches into hyperlordosis). The patient seemed tensed, and may have been uncomfortable and this may have had an influence on her posture.

Iliopsoas, erector spinae, pectoralis major and minor, suboccipital and trapezius are among muscles that should be ROM examined according postural examination findings. Balance and sensation of feet should be examined, and strength of abdominal, neck flexors, middle and lower trapezius, hip extensors and calf muscles. Further breathing examination in supine would help to determine the main breathing pattern of the patient.

3.3.2 Palpation examination

Soft tissue:

Skin inspection: No increased perspiration, colour or temperature changes detected.

Kibler Fold test: Positive in middle thoracic area both sides, HAZ present and patient reports pain.

Fascia: Thoracolumbar fascia has small restriction in cranial direction left side.

Muscles:

Left	Muscle	Right
Hypertonus with TRP	Upper trapezius	Hypertonus with TRP
Hypotonus	Middle trapezius	Hypotonus
Hypotonus	Lower trapezius	Hypotonus
Hypertonus in cervical part and lower thoracic/upper lumbar part. Hypotonus of middle thoracic part.	Erector spinae	Hypertonus in cervical part and lower thoracic/upper lumbar part. Hypotonus of middle thoracic part.
Hypotonus with tenderpoint	Supraspinatus	Hypotonus with tenderpoints
Hypertonus	Pectoralis minor	Hypertonus
Tenderpoint in middle and upper fibers.	Pectoralis major	Normal tonus
Slightly hypertonus with tenderpoint	Quadratus lumborum	Slightly hypertonus with tenderpoint.
Uncomfortable*	Iliopsoas (iliacus)	Uncomfortable*
Hypotonus with tenderpoint (sacrum origin)	Gluteus maximus	Hypotonus
Hypertonus with TRP	Gluteus medius	Normal tonus
Hypertonus	Piriformis	Normal tonus
Normal tonus	Hamstrings	Normal tonus
Little hypertonus	Adductors	Little hypertonus
Little hypertonus	Rectus femoris	Little hypertonus
Hypotonus	Rectus abdominis	Hypotonus

Tab. 3.4. Palpation results of muscles.

* Patient felt the palpation as very uncomfortable.

Neck and jaw:

Normal tonus of the muscles of the jaw: Masseter and Anterior Digastric tenderness. Tenderness in the insertion (mastoid process and nucheal line acc. Kendall [14]) of Sternocleidomastoid, and tenderness with hypertonus in the sub-occipital extensors (Rectus capitis posterior major and minor, Obliquus capitis inferior and superior acc. Kendall [14])

Pelvis:

Iliac crest; symmetrical

ASIS; symmetrical

PSIS; symmetrical

Anteversion/Retroversion; ASIS caudal position on both sides- anteversion.

Coccygeal bone:

- Present coccyalgia.

Conclusion of palpation examination:

Patient has hypotonus in typically phasic muscles, like middle and lower trapezius, rectus abdominis, gluteus maximus, and midthoracic portion of the erector spinae. There is therefore reason to believe that there is muscular dysfunction. Typical postural muscles like cervical and lumbar part of erector spinae, piriformis, adductors of thigh, and rectus femoris have hypertonus. There are HAZ in the midthoracic area and small restriction of thoracolumbar fascia in cranial direction. Patient has also TRP, which can be the cause of other satellite trigger points or tenderpoints. Each TRP has its own pain pattern, and patient has a TRP in gluteus medius which, (acc. Finando [16]), has a pain patter in the low back. Muscle testing of abdominal muscles and hip extensor, together with ROM testing of hip flexors, and low back muscles, should be elaborated due to the findings of anteversion of pelvis.

3.3.3. Anthropometrical measurements

Functional length of lower extremities (from navel to medial malleolus):

Right: 91 cm

Left: 91 cm

Anatomical length of lower extremities (from trochanter major to lateral malleolus):

Right: 73 cm

Left: 73 cm

Circumference of the thigh (15 cm above knee cap):

Right: 47 cm

Left: 48 cm

Conclusion of anthropometrical measurements:

There is no difference in length of lower extremity, which corresponds to the palpation of pelvis, where there was no tilt of pelvis. Circumference of the thigh differed by 1 cm, which is a small difference. Since no great atrophy of leg, there is likely that there is no disc herniation, when a typical sign is atrophy of leg in affected side.

3.3.4. Range of motion examination:

1. Measured with Goniometry and according the SFTR method.

		Right		Left	
		Active	Passive	Active	Passive
Hip joint	S	10-0-100	15-0-125	10-0-100	15-0-120
	F	35-0-20	45-0-30	35-0-20	45-0-30
	R	40-0-25	45-0-30	40-0-25	45-0-30
Knee joint	S	0-0-130	0-0-140	0-0-130	0-0-140
Ankle joint	S	15-0-40	20-0-45	15-0-40	20-0-45

Tab.3.5. Goniometry examination.

2. Vertebral column- global test [12] [1]:

Movement	Right	Left
Lateral flexion of trunk*.	17 cm	13 cm

Tab.3.6. Lateral flexion of trunk.

*Measured from tip of 3rd finger from starting to end position.

Test	Result	Comment
Thomayer's distance	+ 7 cm.	Pain present. Flat lumbar spine.
Shober's distance/sign	+ 4 cm.	
Stilbor's distance	+ 7 cm.	

Test	Result	Comment
Otto's distance	+ 5 cm.	
Flesh de Forestier	+ 5 cm.	
Cepoj's distance	+ 2 cm.	
Neck flexion	3 fingers	From chin to chest.

Tab.3.7. Global tests of the vertebral column.

3. Muscle length test (acc. Janda [12]):

Muscle	Grade of shortness.	
	Right	Left
Gastrocnemicus	0	0
Soleus	0	0
Iliopsoas	0	0
Rectus femoris	0	0
Hip adductors -One joint -Two joint	 0 0	 0 0
Internal rotators of the hip	1	1
External rotators of the hip	0	0
Tensor fascia latae	0	0
Hamstrings	0	0
Extensors of the back	1	
Quadratus lumborum	1	1
Pectoralis minor	0	1
Pectoralis major -Upper fibers -Middle fibers -Lower fibers	 0 0 0	 1 0 0
Upper trapezius	1	1
Muscle	Grade of shortness	
Levator scapulae	1	1
Short extensors of neck	1	1
Sternocleidomastoid	0	0

Tab.3.8. Muscle length testing.

3.3.5 Gait examination

- Forward, open eyes gait:

  - Slow, unnatural walking due to location
  - Small steps with shortened extension phase of both legs.
  - Rebound phase on medial side of feet
  - No synkinesis of trunk.
  - No swinging phase of arms.
  - Head flexed downwards.

- Forward, closed eyes gait:

  - Unstable walking
  - Very slow walking
  - Titubation on unreel phase

- Heel gait:

  - Instability
  - Titubation
  - No signs of nerve lesion of L4-L5.

- Tiptoe gait:

  - Instability
  - Little pain present in low back.
  - No signs of nerve lesion of S1.

3.3.6 Manual muscle testing

- According Key to muscle grading by Kendall [26]:

Muscle	Right	Left
Abdominal - Upper part - Lower part	3, forward head posture 4 minus.	
Trunk oblique test	4 minus.	3 plus.
Deep neck flexors	3, tremor present	
Lower Trapezius	4 plus	3 plus
Middle Trapezius	4	4

Muscle	Right	Left
Rhomboids	4 plus	4
Back extensors	5	
Hamstrings Medial part. (S.T:S.M) Lateral part. (B.F)	 5 4	 4 plus 4
Gluteus maximus	4	4
Gluteus medius	5	5
Gluteus minimus	5	5
Iliopsoas	5	5
Quadriceps femoris	4 plus	5
Gastrocnemius	5	5
Toes flexors	5	5
Toes extensors	4	4

Tab.3.9. Results of muscle strength testing.

Conclusion of muscle strength testing:

The weakness of the abdominal muscles corresponds to the anterior pelvic tilt, and the weakness of the deep neck flexors with the forward head posture. The strength test of the toes showed a little difference between flexors and extensors, probably due to the forward loading of body and increased activity of the flexors of the toes. The tenderpoint and hypotonus of the middle thoracic spine corresponds to the test results. Patient had increased weakness of the lower trapezius on left side. Since the iliopsoas is strong there is likely that the patient has a lordotic posture, contra swayback posture where the iliopsoas is mostly weakened. [26]

3.3.7. Neurological examination

Tendon reflexes:

Tendon	Result
Patella	Physiologic
Achillies	Physiologic

Tab.3.10. Tendon reflexes

Pathological reflexes:

Name of test	Result
Babinsky	Negative
Chaddock	Negative

Tab.3.11. Pathological reflexes.

Subjective light touch:

According dermatomes of the lumbar and sacral plexuses according to Herlin [6]:

- Negative.

Pain sensation by "sharp or dull" object: [18]

- Negative
- Neither tickling nor pain perception in feet; "dead" feet.

Position sense:

- Negative

Lasegue sign:

- Negative

Reverse Lasegue sign:

- Negative

Conclusion of the neurological examination:

There is no sign of radicular pain, which leaves somatic referred pain. Patient showed no signs of paresthesia during examination and explained that the feeling has changed since doctor's consultation. Patient has decreased sensation in feet; this may be factor of instability of posture.

3.3.8 Basic movement patterns

- Hip (hyper) extension: Positive.

  Hamstrings initiates movement and activation of gluteus maximus and erector spinae occurs together.

- Abduction of hip: Negative
- Trunk curl up: Positive

There is only a small curling movement of trunk, while there is anterior tilt of pelvis and over-activity of hip joint, and forward head posture.

- Push up: Positive.

Performed on knees; marked winging of both scapulae (scapula alata)

- Head flexion: Positive

Sternocleidomastoid initiates movement with marked forward head protrusion, and hyperextension in the cervicocranial junction.

- Breathing pattern: Chest breather, with almost no visible movement of abdomen. Very silent and little breathing.

3.3.9. Functional test

- Adams forward bend test: No detectable scoliosis—negative.
- Prone knee flexion test: Pain pattern from SI joint, to lumbar spine. No radiating pain.
- Patrick's sign: Soft barrier on right side, little harder on left side, and no restriction in movement.
- Trendelenburg: Negative
- Overtake phenomenon: left PSIS "goes up" but does not remain- negative
- Spine sign: separation of L5 and PSIS- negative.

3.3.10. Manual method examination (joint play):

The joint play examination is performed according to Mr. Mennell.

Isometric resistance test for muscle lesion:

- Of the neck in flexion, extension, lateral flexion and to rotation, is negative.
- Of thoracic spine; negative.

Joint play:

Joint examined:	Result:
Atlanto- occipital joint - Rotation - Lateral flexion - Anteflexion - Retroflexion	 No restriction present No restriction present Small restriction No restriction
Cervical spine, individual segments	No restriction present

Joint examined:	Result:
Thoracic spine, - Individual segments - Springing action	 No restriction present No restriction present
Lumbar spine, - Individual segments - Springing action	 No restriction present No restriction present
SI joint, - Stoddard's maneuver - Upper part - Lower part	 Little restriction on left side No restriction present Little restriction on left side.
Ankle joint Talocrural joint Chopart joint Lisfranc joint	 No restriction present No restriction present No restriction present

Tab.3.12. Manual method examination.

3.3.11. Conclusion of initial kinesiologic examination.

- Patient has no sign of disc herniation or any neurological abnormalities.
- Active TRP in gluteus medius which self can cause radiating pain in low back and to crest of ilium, SI joint and the sacrum. Cause is chronic overload and SI dysfunction. Satellite tender point in quadratus lumborum. TRP in upper trapezius has an affect on the respiratory system. [6]
- Muscle imbalance with clinical evidence like forward head posture and decreased strength of neck flexors and tight suboccitpital muscles. Relative type I muscle fiber hypertrophy on symptomatic side (upper lumbar part of erector spinae, left side) and bilateral, type II muscle fiber atrophy (midthoracic portion of erector spine, right side, and lower and middle trapezius, right side). [15]
- One of the most clinically relevant patterns of muscle dysfunction is the lower crossed syndrome according to Janda. The combined result is that the lumbosacral, thoracolumbar, SI, hip and knees joints are all overstressed. Joint dysfunction and triggerpoints naturally result from these muscle imbalances, accompanied by low back pain, buttock pain, pseudo-sciatica, and knee disorders. Postural findings; lumbar hyperlordosis, anterior pelvic tilt, protruding abdomen, foot turned out, hypertrophy of

thoracolumbar junction. Dysfunction; weak Gluteus maximus, weak abdominal, shortened Piriformis and Quadratus lumborum. Hip extension pattern and trunk curl up is altered. [15]

- Patient is stressed about work and is not aware of her slumped posture.

3.4. Short-term and long-term rehabilitation plan.

Short-term plan:

- Decrease pain
- Relaxation of shortened muscles
- Releasing of TRP
- Improve breathing pattern
- Release restriction in left SI joint
- Instruction of correct sitting by Brugger, standing up from bed, and posture.
- Auto-therapy, instructions for correct performance.

Long-term plan:

- Correct the muscle dysbalance
- Improve strength of weakened muscles
- Strengthen the arches of the feet together with improvement of sensation.
- Improve ADL and awareness of posture.
- Activate patient.

3.5 Rehabilitation

3.5.1. Therapy session 08/01/07. (08,00-09,30)

Initial kinesiologic examination

Therapy:

➔ Soft tissue technique (with soft ball) on middle and upper thoracic area and cervical part.

➔ PIR of upper trapezius and gluteus medius and piriformis.

➔ Strengthening exercise for deep stabilization system of trunk, with activation of neck flexors.

➔ Mobilization of left SI joint by Stoddard's maneuver.

➔ Instructions of Brugger position, getting out of bed, lifting maneuver and encouragement for active posture.

Electrotherapy:

- Interferential current- bipolar application on each side of lumbar spine. 15 minutes, 80+20= 100 HZ. Sensitive threshold.

Auto-therapy:

- Auto mobilization of SI joint acc. Mojzizova.
- Strengthening exercise for deep stabilization system of trunk.
- Self-stretching of upper trapezius, gluteus medius and piriformis.
- Activity- walk in a forest or a park with good supporting shoes. (recommended backstroke swimming, but she is afraid of water.)

Result of therapy:

Subjective:

She feels less pain in the low back, and is very motivated to do exercises. She doesn't know if she will have time to walk before next session.

Objective:

- Pain in maximum flexion and extension in standing.
- No restriction in SI joint
- Still stressed about work, but is motivated to do exercises.

3.5.2. Therapy session 10/01/07. (08,00- 09,15)

Status present:

Subjective:

Patient has a little pain in the lumbar part, with the same characteristics from first session. She feels no pain in the thoracic part, only when palpated. She has performed the exercises every day, and walked one hour on Tuesday 09/01/07.

Objective:

- Slumped posture- protruded abdomen, forward head posture, and anteversion of pelvis with hyperlordosis.
- TRP in upper trapezius both sides.
- Pain in the lumbar area during maximum flexion in standing (Thomayer's distance 7 cm), during extension no pain.
- Slight restriction in left SI joint by Stoddard's maneuver.
- No restriction in upper or lower ligaments in SI joint, by joint play.
- Lateral flexion of trunk to the left is decreased
- Better mobility in the anteflexion of the atlanto-occiput joint.

- Difficulty with retroversion of pelvis in the auto-therapy exercise for strengthening of deep stabilization system of trunk.
- Weight test—left 35 kg—right 30 kg.
left 33 kg—right 32 kg.

Therapy:

➔ Thoracolumbar stretching in cranial direction

➔ Kibler's fold on middle thoracic area, with ball soft tissue massage on same area with upper trapezius and neck.

➔ PIR of upper trapezius both sides.

➔ Deep stabilization of trunk strengthening exercises with overball, to promote retroversion of pelvis.

➔ Instructions for correct breathing pattern, with activation of abdomen, in supine position.

➔ Mobilization by Stoddard's maneuver in left SI joint, and traction into flexion of lumbar part.

➔ Small feet activation: in sitting, with load, and standing.

➔ Proprioceptive fascilitation of feet in the gym, with walking on stones and mat with spikes. Instructions for correct posture of body while walking.

Auto-therapy:

- Auto mobilization of left SI joint in prone position.
- Strengthening of deep stabilization system of trunk exercises.
- Small feet activation and stroking of her feet.
- Ante flexion of head in sitting position.
- PIR of upper trapezius and masseter.
- Correct performance of ADL.

Electrotherapy:

- Interferential current- bipolar application on each side of lumbar spine. 15 minutes, 80+20= 100 HZ. Sensitive threshold.

Results of therapy:

Subjective:

Patient feels good, and no pain in the lumbar spine, however, she feels a little tired. She feels that the exercises suits her very well, and is very motivated to do them.

Objective:

- Less stressful today.
- Difficulties with performing small feet.
- No restriction in the SI joint
- No pain during flexion of trunk

- Weight test; left 33 kg—right 32 kg. (Same result twice)
- During the exercises patient complained about pain different places, but after asking if she can explain the pain she changes her pain perception to "a strange feeling". Which can be concluded as activation of muscles.

3.5.3. Therapy session 12/01/07. (08,00-09,15)

Status present:

Subjective:

Patient has no pain sensation in low back. During the auto-therapy of strengthening of deep stabilization system of trunk, she felt tension in the low back. Has her period, but has not increased pain as she used to have. She has not been able to walk this time.

Objective:

- Observed patient while walking to the hospital, very rigid walking, almost no swinging phase of arms and no rolling of feet. Looks tensed.
- Confronted patient about her walking pattern and she agreed to the tensed position, she feels "stiff"
- No restriction in left SI joint by Stoddard's maneuver or upper and lower ligaments testing by joint play.
- Activity of abdomen during standing, patient corrects herself and is focused on posture.
- Less tension in upper trapezius and no pain in middle thoracic area.

Therapy:

➔ Breathing exercise according "Lung physiotherapy." [24]

➔ McKenzie exercises number 1, 2, and 3 [16]

➔ Stretching of low erector spinae.

➔ Exercises in the gym;

- Overball exercises with movement of pelvis.
- Balance board exercises with small feet, sudden push from PT, closed eyes, catching ball and one leg standing.
- Proprioceptive fascilitation by walking on stones and mat with spikes.
- Correction of posture and gait in front of mirror.
- Strengthening exercises for lower trapezius and rhomboids, and gluteus maximus.
- Gymnastic ball exercises including Brugger sitting position, balance exercises, and rolling exercises for relaxing.
- Hanging by the hands in the rib wall

Auto-therapy:

- Stretching of the pectoralis muscles and quadratus lumburum
- Small feet activity
- Strengthening exercises for gluteus maximus and the deep flexors of the neck.
- McKenzie exercises 1, 2, and 3. [16]
- Full focus on correct posture with the most optimal breathing pattern.
- Relaxation with a hot water bottle in lumbar spine.

Electrotherapy:

- Interferential current- bipolar application on each side of lumbar spine. 15 minutes, 80+20= 100 HZ. Sensitive threshold.

Result of therapy:

Subjective:

Feels good, and has no pain. Enjoyed the exercises in the gym very much, especially the gymnastic ball.

Objective:

- Good performance of all the exercises applied, improvement of small feet.
- Can see improvement of posture and exercises with deep stabilization system of trunk, due to improved concentration.
- No pain during flexion or extension; Thomayer's distance- 5 cm.
- No restriction in left SI joint.
- No pain in middle trapezius by palpation.

3.5.4. Therapy session 15/01/07. (08,00- 09,15)

Status present:

Subjective:

Has performed exercises during the weekend and been pain-free, but on Sunday 14/01/07 she felt pain again in lumbar area. She walked 1 hour on Sunday, but did not do her auto-therapy exercises that day. (She comments the weather, how it has turned colder, and believes that it has affected her back). Her colleagues helps her when she "falls" into old pattern in standing, and she feels that it is nice to have a reminder like that.

Objective:

- Activation on abdomen during standing, less forward head posture, and hyperlordosis is still present. Improved alignment of whole body, less stooped posture.
- Palpable pain in thoracic area
- Left piriformis tension on palpation

- Tensed Atlanto-occipital joint in anteflexion
- No restriction in left SI joint by Stoddard's maneuver.
- Improved left lateral flexion of trunk.
- Little pain during flexion of trunk.
- "Dead" feet sensation.

Therapy:

➔ Soft massage of soft tissues and muscles in neck area and middle thoracic, esp. in the short extensors of neck with stretching/PIR.

➔ Stretching of piriformis according Finando [6]

➔ PIR of low part of erector spinae

➔ Breathing wave exercises according "Lung physiotherapy" and activation of pelvic floor and diaphragm in the Trendelenburg position [24] [18]

➔ McKenzie exercises 1, 2, 3 and 5. [16]

➔ Strengthening exercise; four legs standing with elevation of one extremity.

➔ PNF of the abdominal muscles.

➔ Strengthening and activation of gluteus maximus in prone with tilting of pelvis

➔ In the gym;

- Gymnastic ball exercises
- Deep stabilization exercise repetition.
- Soft balance pillow standing in front of a mirror.
- Proprioceptive fascilitation of feet.
- Small feet repetition, walking on sandals with ball under the sole.
- Stretching of pectoralis muscles.
- Hanging by the hands in the rib wall.
- Strengthening of middle back with thera-band.

Auto-therapy:

- As 12/01/07.
- Stretching of piriformis.

Electrotherapy:

- Interferential current- bipolar application on each side of lumbar spine. 15 minutes, 80+20= 100 HZ. Sensitive threshold.

Result of therapy:

Subjective:

Patient feels no pain. She feels generally better.

Objective:

- Visible progress in posture and during all movement.
- No tension in the small neck extensiors
- Thomayer's distance 5 cm and pain-free.
- Able to perform small feet without any problems.
- Increased synkinesis of arms during walking, however, she still looks a little rigid.

3.5.5. Therapy session 17/01/07. (08,00-09,15)

Status present:

Subjective:

Feels no pain in the lower back or in the middle thoracic area. However, she feels pain in the right lower rib cage. More specified in the intercostals space (cannot point or explain to a specific place), and the pain is aggravated during deep inhalation, laughing and coughing. Onset of the pain was 16/01/07 in the afternoon, and she believed it to occur slowly, there was no accident or fall or hit to the rib cage. It is local pain, but as mentioned she cannot specify exactly where. Patient wants to have therapy and claims that her pain is not of high intensity.

Objective:

- Palpable pain medially and under rib 8 and 9. No pain felt on palpation of the costals.
- No irritation sensation of the skin over the costal margins of the anterolateral abdominal wall, (present if irritation of peripheral regions of the diaphragm, innervated by the inferior intercostals nerves).
- Sternum compress test- negative, no fracture of rib. [6]
- No blockage or restrictions in any of the ribs. Pain is felt during Stoddard maneuver in inspiration restriction, but no actual restriction is felt. [21]
- No pain during lateral flexion or extension. ROM of LF; right 20 cm, left 18 cm.
- Thomayer's distance- 0 cm. little pain in right rib.
- During deep inspiration, pain is felt deep on right side, where the pain was palpable. - Most likely Diaphragm soreness after activation through exercises in the last therapy sessions or muscle fascia irritation.

Therapy:

➔ Side lying breathing exercise with activation of diaphragm and pelvic floor.

➔ Soft stretching of Quadratus lumborum

➔ McKenzie exercises 1, 2, 3 and 5. [16]

➔ Deep neck flexors activity with flexion of head.

➔ Strengthening exercise on 4 legs standing, strengthening of middle and lower trapezius with thera-band.

➔ Proproceptive fascilitation of feet in the gym.

➔ Repetition of correct lifting maneuver and Brugger sitting position.

Electrotherapy:

- Interferential current- bipolar application on each side of lumbar spine. 15 minutes, 80+20= 100 HZ. Sensitive threshold.

Result of therapy:

Subjective:

Felt no pain during exercises and believes to feel better.

Objective:

- Has difficulties with tilting the pelvis, a staccato and only very small movement is present.
- Very little activation of pelvic floor.
- Deep neck flexors is stronger.
- No tension in the small extensors of the neck and upper trapezius is less tensed.
- Gait has improved, increased synkinesis with arms and trunk, though there is still not optimal rolling phase of feet.

3.5.6 Therapy session 19/01/07. (08,00-09,15)

Final kinesiologic examination

Status present:

Subjective:

Patient has not worked since last therapy session, and feels very little pain in the under the right 8-9 costal bone. She has used hot water bottle on the painful spot and felt it relieving. She has performed her exercises and walked 1 ″ hour 18/01/07. No pain in the low back or middle thoracic area.

Objective:

- Tenderness in sub costal area of 8 and 9 costal bone upon palpation.
- Patient is calm and relaxed, and she has also the day off today.

Therapy:

➔ Exercises in the gym;

- Gymnastic ball exercises
- Proprioceptive fascilitation with stones and mat with spikes.
- Walking on sandals with ball underneath.
- Balance board with small feet.

Auto-therapy:

- All of the previous auto-therapy programs are recommended.

Electrotherapy:

- Interferential current- bipolar application on each side of lumbar spine. 15 minutes, 80+20= 100 HZ. Sensitive threshold.

Result of therapy:

Subjective:

Patient has no pain and feels very good. She is satisfied with the exercise program and the auto-therapy exercises throughout the two weeks therapy sessions. She is very motivated to continue with the exercises and the correct ADL methods.

3.6 Final kinesiologic examination.

3.6.1 Postural examination by inspection

This text type indicates a change of the result since the initial postural examination.

Posterior view*:

Heel shape and loading	Symmetrical round.
Feet and loading	Right foot in external rotation.
Calf- shape and size	Right calf increased concavity on superior fibula side, symmetrical lateral part.
Popliteal lines	Right line higher
Thigh contour and size	**Symmetrical**
Sub-gluteal lines	**Symmetrical**
Tiles	**Symmetrical**
Back, curvatures, trophy of paravertebral muscles.	**Decreased** hyperlordosis of lumbar spine, hypertrophy of erector spinae in left upper lumbar spine.
Inferior angle of scapula	Left higher.
Scapulas position	**Decreased** abduction of both, more abd. In left.
Shoulder position	Left higher.
Trunk	**No rotation**
Earlobes	**Symmetrical**

Arms	Symmetric pronation, and semi flexion.

Tab. 3.13. Posterior final postural examination. *See supplement Fig.7.4

Lateral view**:

Feet	Pes planus- flat transversal and **improvement of longitudinal arch**. Symmetrical on both sides.
Knees	Hyperextension of both.
Pelvis	**Decreased** anterversion
Spine curvature	**Decreased** hyperlordosis of lumbar spine, flat thoracic spine.
Abdomen	**Active**
Shoulders	**Symmetrical**
Chest	**Physiologic**
Arms	**Symmetrical semi-flexion in elbows.**
Head	**Slight** forward head posture.

Tab.3.14. Lateral final postural examination. **See supplement Fig.7.5.

Anterior view:

Feet- arches	Flat transversal and **improved** longitudinal arches (Pes Planus). External rotation of right foot.
Loading	**Decreased loading of medial part. Increased loading of whole feet.**
Patella	Symmetrical.
Knee	**No** valgosity of knees, dark spots on both knees due to sun exposure.
Thigh	**Symmetrical**
Navel	Deviated caudal and slightly to the right.
Tile	**Symmetrical.**
Trunk	**No rotation**
Clavicle	Left higher
Shoulder	Left **slightly** higher
Arm	**Symmetrical semi-flexion in elbows**

Head	**Physiologic**

Tab.3.15. Anterior final postural examination.

Breathing observation:

During the static postural examination the patient **had visible breathing of abdomen, ribs and chest and it was possible to see a breathing chain.**

3.6.2. Palpation examination

Kibler Fold test: **No HAZ** in middle thoracic area of either side.

Fascia: **No restriction** of thoracolumbar fascia.

Muscles:

Left	Muscle	Right
Normal tonus with tenderpoint	Upper trapezius	**Normal tonus with tenderpoint**
Hypotonus **(improved)**	Middle trapezius	Hypotonus **(improved)**
Hypotonus **(improved)**	Lower trapezius	Hypotonus **(improved)**
Normal tonus in cervical part and **slight hypertonus** in lower thoracic/upper lumbar part. Hypotonus **(improved)** of middle thoracic part.	Erector spinae	**Normal tonus** in cervical part and **slight hypertonus** in lower thoracic/upper lumbar part. Hypotonus **(improved)** of middle thoracic part.
Hypotonus with tenderpoint	Supraspinatus	Hypotonus with tenderpoints
Normal tonus	Pectoralis minor	**Normal tonus**
Normal tonus	Pectoralis major	Normal tonus
Slightly hypertonus with tenderpoint	Quadratus lumborum	Slightly hypertonus with tenderpoint.
Uncomfortable*	Iliopsoas (iliacus)	Uncomfortable*
Hypotonus **(improved)**	Gluteus maximus	Hypotonus **(improved)**
Hypertonus	Gluteus medius	Normal tonus

Left	Muscle	Right
Normal tonus	Piriformis	Normal tonus
Normal tonus	Adductors	**Normal tonus**
Normal tonus	Rectus femoris	Normal tonus.
Hypotonus **(big imp.)**	Rectus abdominis	Hypotonus ***(big imp)***

Tab. 3.16. Final palpation results of muscles.

* Patient felt the palpation as very uncomfortable.

Neck and jaw:

Normal tonus of the muscles of the jaw: Masseter and Anterior Digastric tenderness. Tenderness in the insertion (mastoid process and nucheal line acc. Kendall [14]) of Sternocleidomastoid, and **no** tenderness with **decreased** hypertonus in the sub-occipital extensors (Rectus capitis posterior major and minor, obliquus capitis inferior and superior acc. Kendall [14])

Pelvis:

Anteversion/Retroversion: Both ASIS in caudal position—**Decreased** anteversion.

Coccygeal bone:

- **Tenderness** of coccygeal bone.

3.6.3 Anthropometrical measurements

Circumference of the thigh (15 cm above knee cap):

Right: **50 cm**

Left: **50 cm**

3.6.4. Range of motion examination

1. Vertebral column- global test:

Movement	Right	Left
Lateral flexion of trunk*.	**21 cm**	**19 cm**

Tab.3.17. Lateral flexion of trunk.

*Measured from tip of 3rd finger from starting to end position.

Test	Result	Comment
Thomayer's distance	**0**	Pain present **in right rib cage.**
Shober's distance/sign	+ **5 cm.**	
Stilbor's distance	+ 7 cm.	
Otto's distance	+ **4 cm**	
Flesh de Forestier	+ **4 cm.**	
Cepoj's distance	+ **3cm.**	
Neck flexion	**2 fingers**	From chin to chest.

Tab.3.18. Global tests of the vertebral column.

2. Muscle length test (acc. Janda [12]):

Muscle	Grade of shortness.	
	Right	Left
Internal rotators of the hip	**0**	1
Extensors of the back	**0**	
Quadratus lumborum	**0**	0
Pectoralis minor	0	**0**
Pectoralis major -Upper fibers -Middle fibers -Lower fibers	 0 0 0	 **0** 0 0
Upper trapezius	**0**	**0**
Levator scapulae	1	1
Short extensors of neck	**0**	

Tab.3.19. Final muscle length testing.

3.6.5. Gait examination

- Forward, open eyes gait:

  - Slow, unnatural walking due to location
  - Small steps with **improved** extension phase of both legs.
  - Rebound phase on **whole** feet
  - **Improved** synkinesis of trunk.
  - **Physiologic** swinging phase of arms.

- Forward, closed eyes gait:
    - Unstable walking
    - **Slow** walking

- Heel gait:
    - Instability
    - No signs of nerve lesion of L4-L5.

- Tiptoe gait:
    - Instability
    - **No** pain present in low back.
    - No signs of nerve lesion of S1.

3.6.6 Manual muscle testing

- According Key to muscle grading by Kendall [26]:

Muscle	Right	Left
Abdominal - Upper part - Lower part	**4** **4**	
Trunk oblique test	**4**	**4**
Deep neck flexors	**4**	
Lower Trapezius	4 plus	**4**
Middle Trapezius	4 **plus**	4 **plus**
Rhomboids	4 plus	4 **plus**
Hamstrings Medial part. (S.T:S.M) Lateral part. (B.F)	 5 4	 **5** 4
Gluteus maximus	**4 plus**	**4 plus**
Quadriceps femoris	**5**	5
Toes extensors	4	4

Tab.3.20. Final results of muscle testing.

3.6.7. Neurological examination

Pain sensation by "sharp or dull" object:

- Negative
- Neither tickling nor pain perception in feet; "dead" feet.

3.6.8 Basic movement patterns

- Hip (hyper) extension: **Negative.**
- Trunk curl up: **Negative.**
- Push up: Positive.
  Performed on knees; **visible** winging of both scapulae (scapula alata)
- Head flexion: **Negative**
- Breathing pattern*:* **Visible** breathing pattern**,** with abdominal **rising** and ribs **flare out,** and final **chest elevation**.

3.6.9. Manual method examination (joint play):

The joint play examination is performed according to Mr. Mennell.

Joint play:

Joint examined:	Result:
Atlanto- occipital joint - Anteflexion	**No** restriction
SI joint, - Stoddard's maneuver - Upper part - Lower part	 **No** restriction on left side No restriction present **No** restriction on left side.

Tab.3.21. Final manual method examination.

3.7. Therapy effect evaluation, prognosis

During the 6 physical therapy sessions patient has changed her slumped, stooped posture pattern, into a physiologic and ergonomic posture pattern. This change of patterns demands in the beginning full cognitive focus, and gradually the pattern will become natural for the patient. With the postural changes and specific exercises applied, the muscle imbalance has reduced. The strength of neck flexors has improved and the tightness of the suboccipital muscles has reduced, which again reduced the forward head posture. The muscle imbalance in erector spinae has also improved, with decreased hypertrophy of upper lumbar part, and increased trophicity on midthoracic erector spinae, and upper and lower trapezius.

The TRP in gluteus medius is no longer there, relieving possibly radiating pain. As for the clinical relevant postural findings for determining the lower crossed syndrome acc. to Janda, they have all improved except for one. Hyperlordosis of the lumbar spine has decreased together with anterversion of pelvis. The abdomen is less protruded and the hypertrophy of thoracolumbar junction has decreased. The restriction in the left SI joint has been mobilized and is not longer present. External rotation in the right foot is still detectable.

The most important sign of positive therapy effect is the patient subjective feeling of pain, which during these two weeks has diminished in the low back. If the patient will continue to do the auto-therapy exercises and maintain a good posture while performing ADL, the prognosis for this patient is daily living without pain.

4. CONCLUSION

According to feedback from the patient, she is no longer in pain, hence it's fair to conclude that the therapy was successful.

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6. LIST OF ABBRIVITATION

abd.	abduction
acc.	according
ADL	activities of daily living
ASIS	anterior superior iliac spine
B.F	biceps femoris
BMI	body mass index
cm	centimeter
esp.	especially
Fig.	figure
HAZ	hyper algesic zone
imp	improved
IV	intervertebral
kg	kilogram
LBP	low back pain
LF	lateral flexion
PIR	postisometric relaxation
PNF	proprioceptive neuromuscular fascilitation
PSIS	posterior superior iliac spine
PT	physiotherapist
ROM	range of motion
SI	sacro-iliac
S.M	semimembranosus
S.T	semitendinosus
Tab.	Table
TENS	transcutaneus-electro-neuro-stimulation
TRP	triggerpoint
U.S	ultrasound

7. SUPPLEMENT

Fig. 7.1. Initial posterior postural examination.

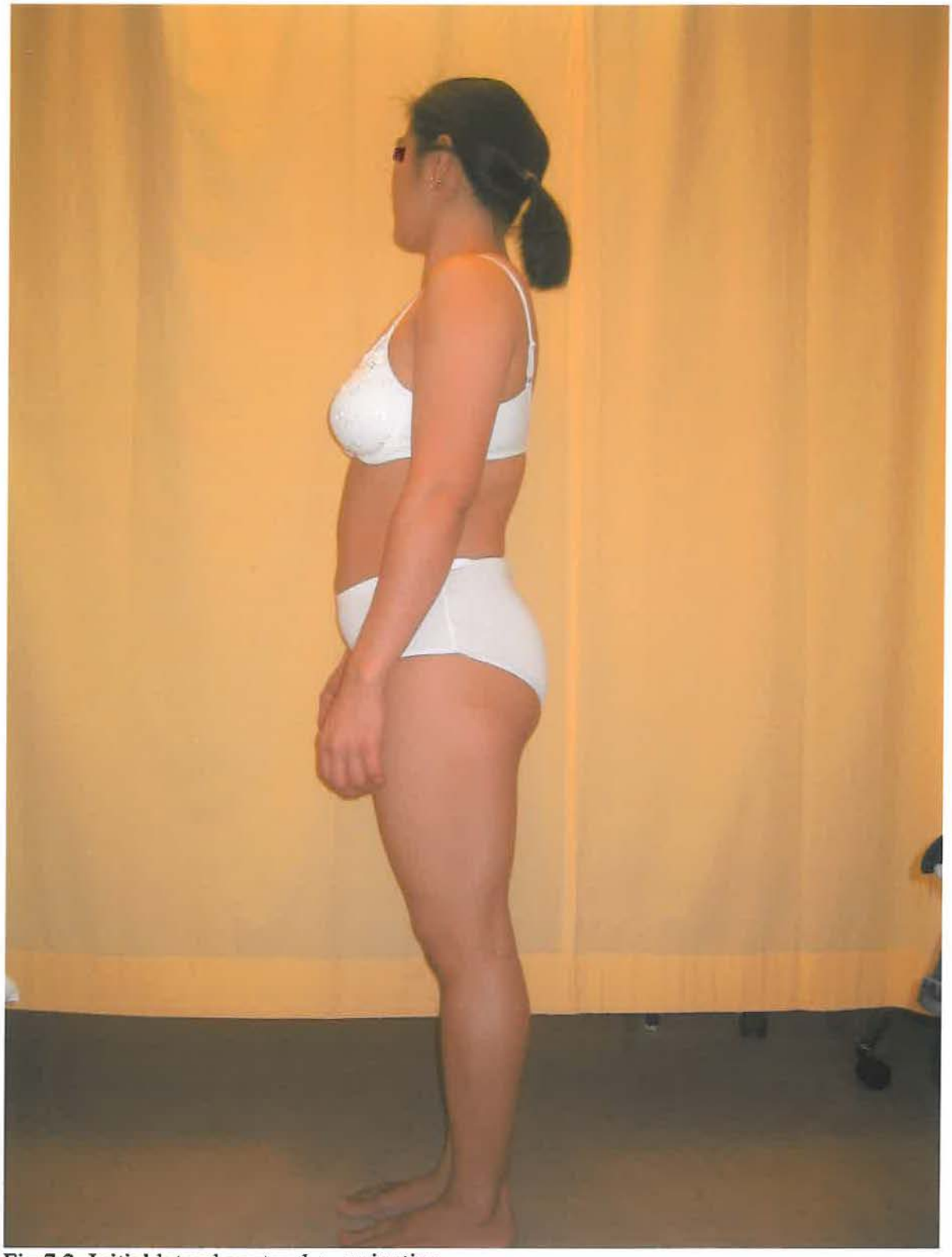

Fig.7.2. Initial lateral postural examination.

Fig. 7.3. Initial postural examination of feet.

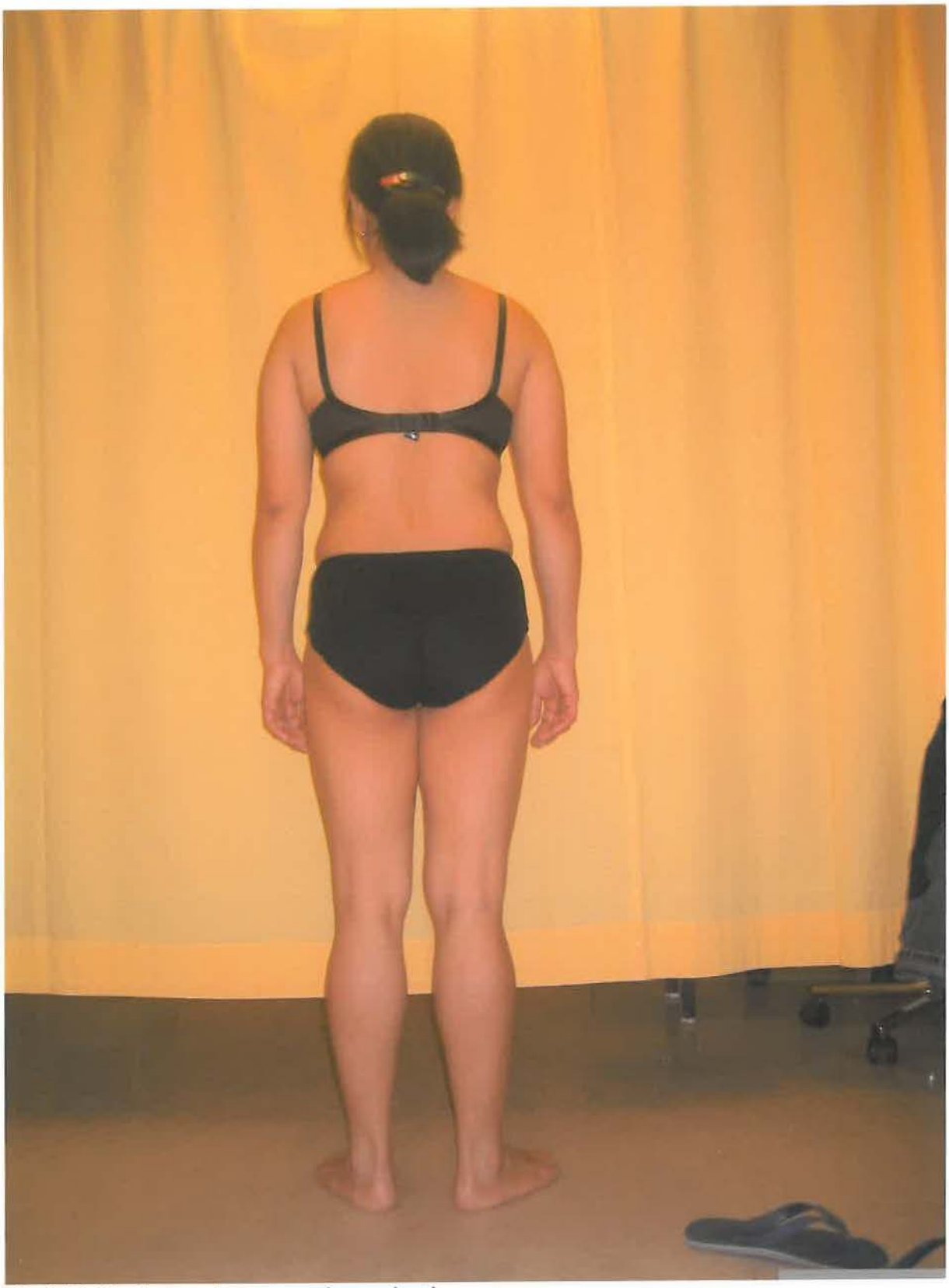

Fig. 7.4. Final posterior postural examination.

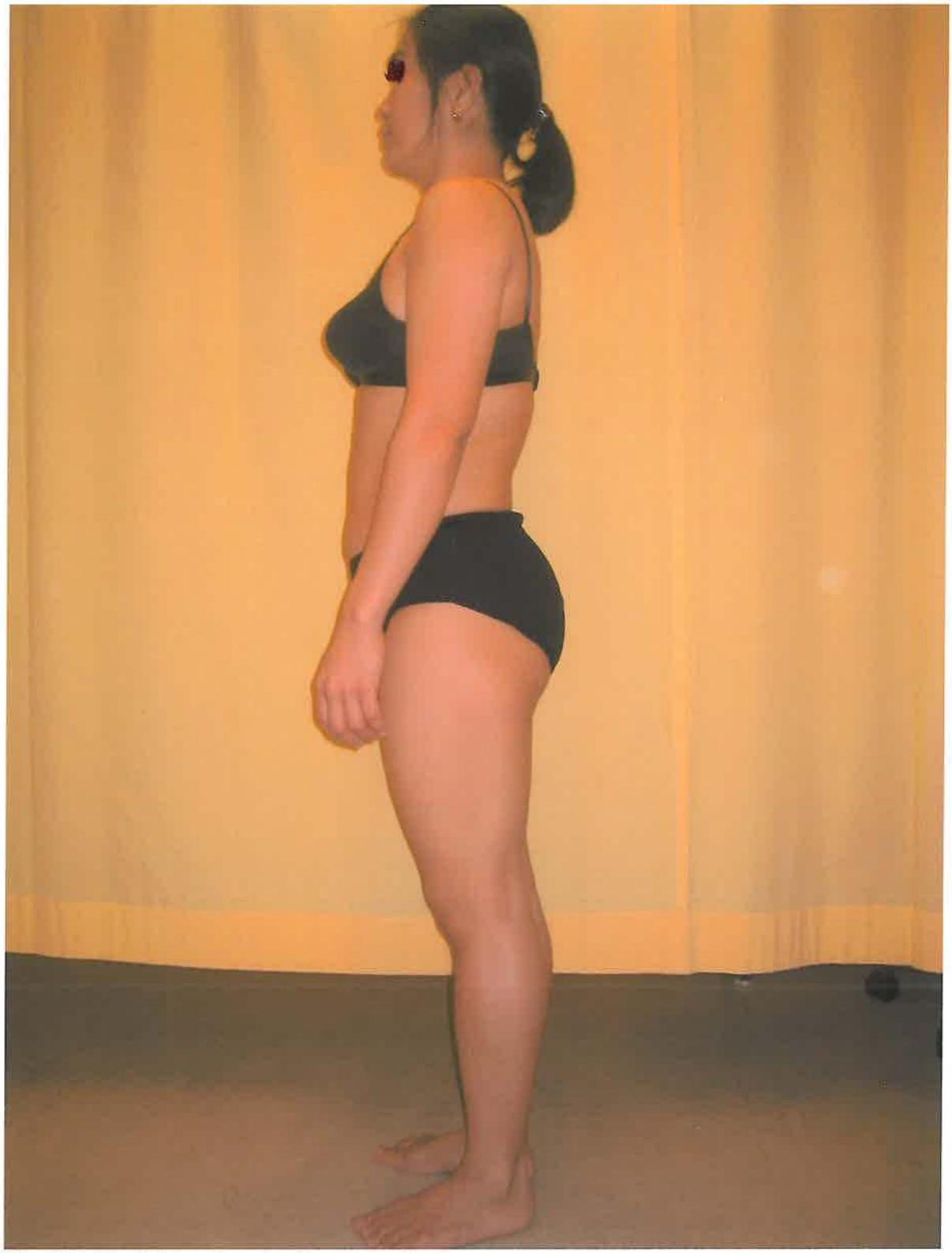

Fig. 7.5. Final lateral postural examination.

Fig. 7.6. Initial sitting position.

Fig. 7.7. Final sitting position.