

CHARLES UNIVERSITY IN PRAGUE

Faculty of Physical Education and Sport
Department of physiotherapy

**Case Study of Physiotherapy Treatment of a
Patient after Total Hip Replacement**

Bachelor Thesis

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Prague 2016

Abstract

Title of thesis: Case Study of Physiotherapy Treatment of a Patient after Total Hip Replacement.

Work placement: Fakultní Nemocnice Královské Vinohrady

Summary:

This bachelor thesis consists of two parts, one theoretical and one special part. The first theoretical part includes anatomy, kinesiology, biomechanics and pathology of the hip joint. The special part consists of a case study that is based on observations and clinical work at FNKV of a 59- year old woman after operation of total hip replacement. It includes initial and final kinesiological examination, day-to-day therapy and a conclusion of the whole process.

The main goal is for the patient to become self-sufficient and be able to do activities of daily living without pain. The methods used in the therapy for this thesis were mainly manual techniques and exercises based on active movements to strengthen and increase range of motion in the operated hip joint. No invasive methods were used.

Keywords: total hip replacement, hip joint, rehabilitation, coxarthrosis, degenerative joint disease, physiotherapy

Abstrakt

Název Práce: Případová studie fyzioterapie léčby pacienta po totální endoprosthesis kyčelního kloubu

Pracoviště: Fakultní Nemocnice Královské Vinohrady.

Shrnutí: Tato bakalářská práce se skládá ze dvou částí – teoretické a speciální. První teoretická část práce zahrnuje anatomii, kineziologii, biomechaniku a patologii kyčelního kloubu. Speciální část obsahuje případovou studii založenou na pozorování a klinické práci ve Fakultní Nemocnici Královské Vinohrady (FNKV) s 59letou pacientkou po totální endoprotéze kyčelního kloubu. Obsahem je vstupní a kontrolní kineziologické vyšetření, popis terapií a závěr léčebného procesu.

Hlavním cílem pacientky je dosažení sebe-obslužnosti a být schopna provádět aktivity běžného denního režimu bez bolesti. Hlavními metodami použité v terapii v této práci byly manuální techniky a cvičení založené na aktivním pohybu k posílení a zvýšení rozsahu pohybu operované kyčle. Nebyly využity žádné invazivní postupy.

Klíčová slova: totální endoprotéza, kyčelní kloub, rehabilitace, koxartróza, degenerativní onemocnění kloubu, fyzioterapie

Declaration

I declare that this bachelor thesis was written by me, and it's based on the knowledge from lectures and seminars from FTVS and from books, articles and journals.

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

Mona Skjaanes

Prague, April 2016

Acknowledgement

I would like to thank Charles University for the opportunity to study and learn from some great teachers. I would especially like to thank PhDr. Ivana Vláčilová, Ph.D., who has been so kind and guided me during this period of writing the thesis.

I am grateful to Daniela Popov for being my friend, motivating me in good and bad times, and for encouraging me to finish this thesis. I also appreciate the opening hours of Národní technické knihovna (NTK) in Dejvice.

At last, I would like to thank all my friends at Charles University for all the good memories and fun we've had together.

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1. Introduction

This thesis includes theoretical and practical aspects of a case study of physiotherapy treatment of a patient after total hip replacement, due to coxarthrosis. The case study is based on clinical work at Fakultní Nemocnice Královské Vinohrady from the period 18.01.16-29.01.16. The case study concerns a 59-year old woman, who is 11 days after total replacement of the right hip. The replacement was done as a result of coxarthrosis. Coxarthrosis is a degenerative joint disease, which is due to chronic overloading. The cause of this disease is usually wear and tear from daily life, previous injuries or deformities, which causes the joint to be overload.

The thesis is divided into two main parts, a theoretical part and a special part. The theoretical part is concerned with the theoretical aspects of anatomy, kinesiology, biomechanics, coxarthrosis, treatment and rehabilitation of the hip joint. The anatomy includes bones, ligaments, muscles, nerves and blood supply. The theoretical part also includes a part with the diagnosis of the patient, coxarthrosis, which is arthrosis of the hip joint. It includes types of treatment, both non-surgical and surgical treatment, then followed by rehabilitation after total hip replacement.

The special part deals with the patient and the rehabilitation after the total replacement of the hip. It is composed of anamnesis, initial examinations of the patient, short- and long term rehabilitation plans, progression of therapy from day to day, final examinations, and conclusions. The evaluation of the effect of therapy is also described.

2. General part

In the general part, there will be a description of the anatomy of the hip joint, which includes bones, ligaments, muscles, nerves and blood supply to the joint. I will also describe the kinesiology and biomechanics of the joint, and the pathology in my case study, coxarthrosis. The part consists of the clinical presentation, diagnosis and treatment, both non-surgical and surgical procedures and rehabilitation after total hip replacement.

2.1. Anatomy of the hip joint

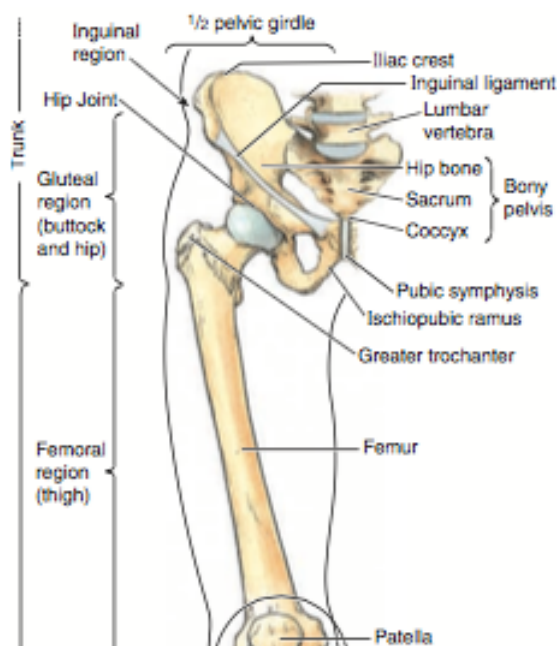
The hip joint is a synovial ball-and socket joint and the major functions are weight bearing and stability. The hip joint is the articulation between the acetabulum of the pelvis and the head of femur (23). The head of femur is covered with articular cartilage and is rounded and smooth, so it fits perfectly into the acetabulum and allows a wide range of movements (9). The hip joint has three axes and three degrees of freedom. A transverse axis in frontal plane, which is the movements of flexion and extension, an anteroposterior axis in sagittal plane, which controls the movements of adduction and abduction and a vertical axis which controls the movements of medial and lateral rotation (14).

2.1.1 Bones

The hip joint consists of two hip bones, which together with the sacrum makes up the pelvic girdle and the femur, which articulates with the acetabulum of the hip bone (10). The pelvic girdle consists of two pelvic bones, one left and one right, which are joined together by the sacrum posteriorly, and anteriorly the two bones form the symphysis pubis. The synovial sacroiliac joints connect the sacrum and the bones of the hip by strong ligaments, and are almost immovable. The ligaments are strong stabilizers of the pelvis, and are divided into the stronger band “Sacrotuberous ligament” which goes from the ischial tuberosity to the sacrum and the weaker band “sacrospinous ligament” runs from ischial spine to the sacrum. The sacroiliac joints and symphysis pubis form the pelvis into a stable ring, which allows limited movements. The functions of the pelvic girdle is to bear the weight of the upper trunk in sitting and standing position, transfer weight from upper to lower skeleton and it provides attachment for muscles that is essential for locomotion (23).

The pelvic bone is made up from three bones, the ilium, the ischium and the pubis. The ilium is the superior part, while the ischium and pubis are posteroinferior and anteroinferior. These bones are fused together during puberty. On the lateral side of the pelvis, is the acetabulum, which is a cup-shaped depression into the bone and it's in the area where the ileum, ischium and pubis are fused together (7). The acetabular labrum is a rim of fibrocartilage, which increases the depth of the joint cavity. The capsule is very strong and dense and encloses both the neck and head of femur (21). Circular fibers around the femoral neck constrict the capsule and help to hold the femoral head in the acetabulum (23).

The femur bone is the largest, longest and heaviest bone in the body, and is a major weight-bearing bone. It consists of a proximal end, a shaft (diaphysis) and a distal end. The proximal end includes the shaft of femur where it continues to the femoral neck and ends with the head of femur. The femoral neck connects the head and shaft of the femur and is angled superomedially from the shaft with approximately 125° . The head articulates with the acetabulum of the pelvis and is spherical. Between the shaft and neck, there is a junction with two processes, the greater trochanter and the lesser trochanter. Both trochanters are attachments for muscles. The shaft goes from the lateral to medial in coronal plane with an angle of 7° from the vertical axis, which makes the distal end closer to the midline. At the distal end the bone forms to femoral condyles (10,13).



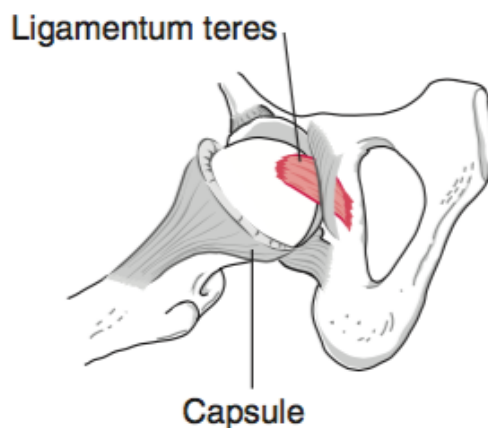
Picture 1: Bones of the hip joint (23).

2.1.2 Ligaments

The capsule of the hip involves a series of ligaments, which can be divided into functional and anatomic components. The primary ligaments are the iliofemoral, pubofemoral, ischiofemoral, the ligamentum teres and the ligament orbicularis (2,9).

There are two intra-capsular ligaments, the transverse acetabular ligament and the ligament of the head of femur. The transverse acetabular ligament attaches to the fibrous membrane that encloses the hip joint. It joins the two ends of the acetabular labrum, forming a complete circle (23).

Ligament of the head of femur (ligamentum teres) goes from the fovea of the head of femur to the acetabular fossa, transverse acetabular ligament and parts of the acetabular notch (7). This ligament is weak and does not help to strengthen the hip, but in 80% of cases, it carries blood supply to the femoral head (18,23)



Picture 2: Ligamentum teres (18).

The extra capsular ligaments are the iliofemoral ligament, the ischiofemoral ligament and the pubofemoral ligament. The Ilio-femoral ligament, also referred to as the Y-ligament of Bigelow, has a triangular shape (Y-shape) and is located anterior to the hip (2). It extends from the anterior inferior iliac spine to the intertrochanteric line (23). It is one of the strongest ligaments in the body and limits excessive extension, abduction and external rotation at the joint line (23). It also plays a role in stabilization and maintaining upright posture (7).

The Ischiofemoral ligament goes from the ischium behind the acetabulum to blend with the capsule. It's considered being the weakest of the extra capsular ligaments, and it contributes to stabilize the hip in extension (7,12,23).

The Pubofemoral ligament has its attached to the superior ramus and joins the iliofemoral ligament (23). It also has a triangular shape and limits excessive extension and abduction of the femur (7). It reinforces the capsule inferiorly, and is connected to the iliofemoral ligament by the circular ligamentum orbicularis. This ligament circumvents the femoral neck (2).



Picture 3: Anterior view of iliofemoral and pubofemoral ligament and posterior view of ischiofemoral ligament (18).

2.1.3 Muscles

The anterior muscle group of the hip joint consists of iliacus m. and psoas m., which together form the iliopsoas muscle. It originates at the iliac fossa, anterior and lateral surfaces of T12 though L5 and inserts at the lesser trochanter. It is a one-joint muscle, works as the primary hip flexor and is very strong. Rectus femoris is a two-joint muscle, which flexes the hip as well as extends the knee. It goes from the anterior superior iliac spine to the tibial tuberosity. The Sartorius muscle goes across the thigh from the lateral side, originating at the anterior superior iliac spine and goes to the medial side of the knee, inserting on the medial aspect of the tibia. It is not a prime mover in any movement, but it assists in hip flexion, abduction, lateral rotation and flexion of the knee. It's most efficient when doing all these movements at the same time (12,18).

The medial muscle group is mainly adductors of the hip. The pectineus muscle provides hip flexion as well as adduction. It originates at the pubis and inserts at the pectineal line of femur. It is a one-joint muscle and works together with the three other one-joint hip adductors. Adductor longus, which is a prime mover in hip adduction, is also the most superficial of the adductor muscles. It goes from the pubis to the mid third of the linea aspera. Adductor brevis is shorter, and lies deeper to the

adductor longus, but more superficial to the adductor magnus. Adductor brevis is also a prime mover in hip adduction and goes from the pubis to the pectineal line and linea aspera. The adductor magnus muscle is the biggest adductor muscle and also a powerful hip adductor. It originates at the ischium and pubis and attaches at linea aspera and adductor tubercle. The gracilis muscle is the only two-joint hip adductor and it assist in knee flexion. It originates at the pubis and inserts on the proximal end of tibia on the anterior medial surface (8,18,27).

The posterior muscle group includes the gluteus maximus, a large one-joint muscle that originates on the posterior sacrum and ilium and inserts on the greater trochanter of femur and iliotibial band. It's function is hip extension, hyperextension and lateral rotation. The muscles covering the posterior thigh are known as the hamstrings muscles and they are the semitendinosus, semimembranosus and biceps femoris muscle. They all originate on the ischial tuberosity and are two-joint muscles. Semimembranosus attaches on the medial condyle of tibia, while semitendinosus inserts at the proximal tibia on the anteromedial surface. The biceps muscle has two head, the long head originates at the ischial tuberosity and the short head on the lateral lip of linea aspera and they both have insertion on the fibular head. Hamstring muscles extend the hip and flex the knee. The posterior aspect also include six deep rotators which are the obturator externus and internus, they both originate at pubis and ischium and attaches to the trochanteric fossa and greater trochanter. Quadratus femoris goes from the ischial tuberosity to the intertrochanteric crest. Piriformis originate at sacrum and inserts at the greater trochanter. Gemellus superior and inferior inserts at the greater trochanter, but originate at the ischium and ischial tuberosity (12,18).

The lateral muscle group consists of gluteus medius, minimus and tensor fascia lata muscles. Gluteus medius muscle originates on the outer surface of ilium and inserts at the greater trochanter. This muscles abducts the hip and assists gluteus medius in medial rotation. The gluteus minimus muscle lies deeper and originates at the lateral ilium and inserts at the greater trochanter. It serves in medial rotation and abduction of the hip. The tensor fascia lata is a small muscle with a long tendon attachment and it goes from the anterior superior iliac spine to the lateral condyle of tibia. It abducts the hip, but is strongest in the combination of flexion and abduction (8,18).

2.1.4 Nerves and dermatome distribution

There are 5 main nerves that innervate the muscles of the hip joint. The femoral nerve innervates the lateral part of pectineus m., quadriceps femoris mm., Sartorius m., and the iliopsoas m.

The obturator nerve innervates the medial part of pectineus m., gracilis m., obturator externus m., adductor longus m., posterior part of adductor brevis m., and adductor magnus m.

Gluteus medius-, minimus, and tensor fascia lata m. are innervated by the gluteus superior nerve. The gluteus maximus is innervated by the gluteus inferior nerve.

The sciatic nerve innervates the proximal part of adductor magnus m., semitendinosus m., semimembranosus m., biceps femoris m., piriformis m., gemellus inferior and superior mm., obturator internus m., and quadratus lumborum m. (26).

Dermatome distribution of spinal nerve roots relevant to the hip and thigh (30):

L1: inguinal and posterior lateral buttock region

L2: anterior and medial thigh, sacroiliac, and iliac crest region

L3: Anterior thigh and medial knee

L4: medial leg and medial foot

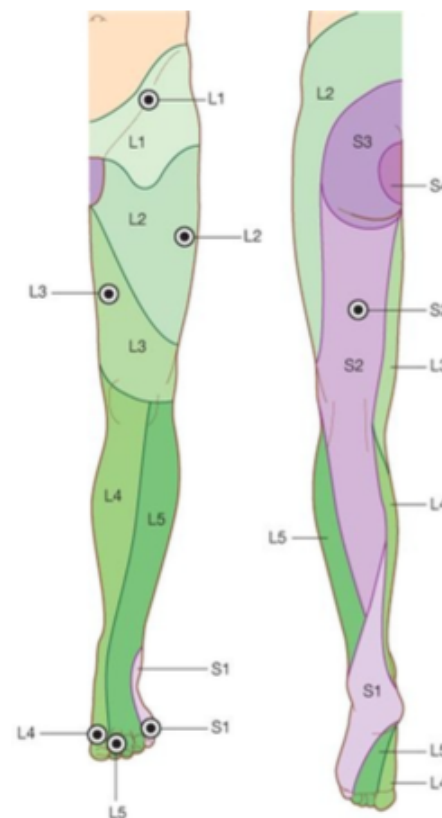
L5: Lateral leg and lateral foot

S1: posterior thigh and lateral foot

S2: posterior thigh and medial ankle

S3: Groin and coccyx region

S4: Coccyx region



Picture 4: Dermatomes of lower extremity (6).

Myotomal distribution of spinal nerve roots relevant to the hip and thigh (30):

L1: Hip flexion

L2: Hip flexion, hip adduction

L5: Hip abduction

S1: Hip extension

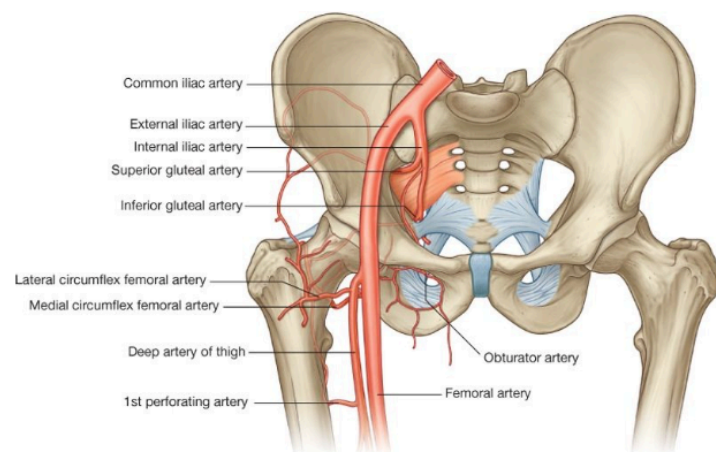
2.1.5 Blood supply

Starting from the abdominal aorta that branch into the left and right common iliac artery. The common iliac arteries then branches into the external and internal iliac arteries. The internal iliac artery is complex and supplies the pelvic and gluteal area as it divides into the obturator artery and inferior and superior gluteal arteries. The superior and inferior gluteal arteries supply the gluteal region (6,24).

The hip joint is supplied with blood from the medial circumflex femoral and lateral circumflex femoral arteries, which are both branches from the femoral artery. The external iliac artery passes through the inguinal ligament and becomes the common femoral artery, and branches into the superficial circumflex artery, the superficial epigastric artery, the superficial external pudenda artery and the deep external pudenda artery (6,24).

The deep artery of the thigh comes off the common femoral artery and supplies the adductors, extensors and flexors of the thigh. It also gives rise to 3 other arteries; the lateral circumflex, the medial circumflex and the three perforating branches, which perforates to the medial thigh.

Blood supply for the head of femur is given by a small branch of the obturator artery through the ligament of the head. (1,6)



Picture 5: Arteries of the hip

joint (6)

2.2 Kinesiology of the hip joint

There are four muscle groups of the pelvic girdle; there are muscles that connect the thorax and pelvis, muscles that connect the lumbar spine and pelvis, muscles holding the pelvic organs and muscles that connect the pelvis to the lower extremity. The connection between thorax and pelvis are done by the abdominal muscles, which are m. rectus abdominis, transversus abdominis m., and internal and external oblique mm. The quadratus lumborum m. is also included. Levator ani and coccygeus muscles hold the pelvic organs. Between the lumbar spine and pelvis is the muscle iliopsoas and connecting pelvis and lower extremities are hip flexors, extensors, adductors, abductors and short external rotators (26,27).

The flexors of the hip joint are iliopsoas, rectus femoris, pectineus, gracilis and adductor magnus muscles. Of these, the main flexor is the iliopsoas muscle. The participation of rectus femoris m. increases with knee flexion. Pectineus m., gracilis m. and adductor magnus m. are in assisted flexion. These five muscles flex the hip in combination with adduction and internal rotation. If the hip flexors become shortened, lumbar lordosis increases (26,9).

Extensors of the hip joint include gluteus maximus m., and hamstring muscles, which are the biceps femoris m., semitendinosus m., and semimembranosus m. The primary extensor is the gluteus maximus, and it's assisted by gluteus medius and minimus mm. The hamstring muscles are primarily flexors of the knee.

Adductors of the hip function to stabilize the hip in walking and running, they are important for postural adaptation and have a tendency to shorten. They are adductor magnus, longus and brevis, gracilis m., and pectineus m. (26,9)

External rotators are piriformis m., obturator externus and internus, quadratus femoris, pectineus, gluteus medius and minimus mm. They press the femur into the acetabulum by external rotation and they tend to limit internal rotation. These muscles have a tendency to shorten. The three muscles tensor fascia lata, gluteus minimus and medius are the internal rotator of the hip (26,28).

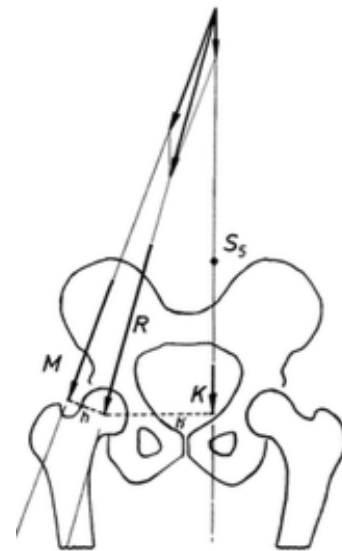
Range of motions in the hip joint (8):

- Flexion: 125°
- Extension: 10°
- Abduction: 45°
- Adduction: 10°
- External rotation: 45°
- Internal rotation: 45°

2.3 Biomechanics of the hip joint

The hip joint is constantly loaded during daily activities throughout life and it's a major weight-bearing joint and serves as a great stability for the trunk and upper body. Standing upright with the body weight evenly distributed on the two legs, the load on each hip is approximately one-third of the total body weight. The strong muscles of the hip cause tension and compression at the joint, making the total load on each hip greater than the weight supported (13,25).

During daily activities, such as walking, climbing and descending stairs, jogging, running and jumping, the loads on the hips increase. Body weight, muscle tension and forces translated upwards through the body all give large compressive load on the hips. As loads on the joint increases, so does the contact area at the joint, so that stress levels remains constant. (13)



Picture 6: forces on the hip joint standing on one leg (20).

Table 1 – Forces on the hip (18)

Forces on the hip	
Standing	0.3 times the body weight
Standing on one limb	2.4-2.6 times the body weight
Walking	1.3-5.8 times the body weight
Walking up stairs	3 times the body weight
Running	4.5+ times the body weight

2.4 Coxarthrosis

2.4.1 Etiology

Coxarthrosis, or hip arthrosis, is a degenerative joint disease that occurs due to chronic overloading. The condition affects the bones, ligaments, cartilage and the joint of the hip. The disease is manifested by changes in the mechanical properties of the cartilage, which protects the bone and makes it move smoothly (16). The most common cause of tissue breakdown is daily wear and tear, and previous injuries sustained throughout life. Cartilage breakdown causes the joint space to become narrow, and the ligaments become lax. When the laxity is increased, there is new formation of bone, called spurs or osteophytes (30).

Coxarthrosis can be divided into two forms, primary (idiopathic) and secondary coxarthrosis. The first type are of unknown cause, and stands for approximately 48% of all cases. The other 52% of cases of coxarthrosis are secondary, which means that the cause is either congenital or acquired defects. Hip dysplasia, dislocation, coxa vara or valgus, Perthes disease, joint damage, obesity, traumatic injuries and joint overloading can lead to coxarthrosis. Other factors that can lead to coxarthrosis are age, gender, weight, infections, joint deformities and occupation (16,30).

2.4.2 Clinical picture

The subjective symptoms of coxarthrosis are joint pain, often referred to the inguinal area with spreading into the medial part of the thigh in direction of the knee. Stiffness, loss of movement, first affected is internal rotation and abduction (17). Activities that provoke pain are typically walking, running, jumping and other types of weight-bearing activities. Standing up over a longer period of time, especially on hard surfaces. Squatting, putting shoes, crossing legs, prolonged sitting or lying (30). Activities that often ease pain are rest, gentle range of motion exercises, stretching and active exercises. Anti-inflammatory medication, use of heat, massage and non-weight-bearing activities can also relieve pain (20,30).

The objective findings are loss of range of motion in the hip joint, especially hip flexion and internal rotation (4). Shortness in muscles of lower extremity with limited mobility that leads to anterior tilt of the pelvis and pelvic rotation, and this causes changes in spinal alignment. Another typical finding is an altered gait pattern,

called “Duck gait”, and it occurs due to weakness in abductor and extensor muscles of the hip (16,19).

2.4.3 Diagnosis

The diagnosis of coxarthrosis is based on clinical examination and radiological findings. CT and MRI are often used. Typical findings are damage to the cartilage, narrowing of the joint space, and osteophytes(16,22).

2.4.4 Non-surgical treatment

All patients with diagnosed coxarthrosis should be informed and educated about their diagnosis, prognosis and types of treatment. Patients are also advised to take an active part in the management of their disease and to maximize the outcome. Overweight and obesity are a risk factor for the development and progression. An exercise program should consist of increasing and maintaining ROM, static and dynamic strengthening, and aerobic conditioning. Occupational therapy can be helpful for making activities of daily living easier and more efficient (11).

2.4.5 Surgical treatment

Surgical treatment depends on the stage and development of the coxarthrosis and is usually done by arthroplasty. A total hip arthroplasty is the replacement of both acetabulum and proximal femur (11).

There are three type of endoprostheses that are used for total hip replacement, cemented, non-cemented and hybrid. The cemented type is when the hip socket and shaft are fixed with quick-hardening antibiotic bone cement. It’s usually implanted in older patients. The non-cemented type is often used in younger patients, and the period of without weight bearing and loading is longer than with the cemented type. The hybrid type combines a cemented femoral component and a cementless acetabular component (15,16,29).

The approach used for surgery depends on the type of access needed, bone reconstruction, hip stability and the experience of the surgeon. There are many approaches to total hip replacement, but the three most known types of approaches are the anterior, lateral and posterior approach. Anterolateral approach has the goal of surgery that includes the relief of pain, a stable prosthetic, restoration of function. It is good for situations where blood supply to the femoral head is necessary to be

reserved, or for prosthetic revision surgery. If the abductor muscles are split incorrectly, or too far proximally, injuries to the neurovascular structures can happen or it can cause permanent muscle weakness (1,3).

In the posterior approach, extra care to avoid injury to the sciatic nerve. This surgery gives access to the posterior part of the capsule. The adductor muscles are preserved, and therefore minimal damage to the muscles with this approach and if posterior soft tissues are closed well, it reduces the risk of posterior dislocation (3,20).

2.4.6 Rehabilitation after total hip replacement

The rehabilitation after total hip replacement can be divided into two phases, a pre-operative phase, which should be provided before the surgery, and a post-operative, which is the rehabilitation after the operation (5,16).

The pre-operative phase is an important phase for the patient, it is beneficial for the post-operative period and the time of post-operative rehabilitation depends on this phase. It includes a full detailed examination with kinesiological and goniometric assessment. It also includes treatment of the affected joint in terms of correcting muscle imbalance, decreasing possible contractures, modification of breathing pattern, and improvement of overall physical fitness. Another part of the pre-operative phase is gait training with forearm or underarm crutches, practicing gait with decreased weight bearing. Patient education is also an important part, which includes education about the early post-operative period, verticalization, and precautions after the operation and education about an active rehabilitation approach (5,16).

The post-operative phase starts immediately after the operation and consists of thromboembolic prevention, positioning, prevention of contractures, breathing exercises, exercises for upper extremity and cryotherapy. On the second or third day after the operation, the patient can stand where transfers are exercises. Gradually, exercises in prone, and side lying on the non-involved extremity with a pillow between the knees are practiced. The exercises should include strengthening for all muscles of the hip and thigh, active, passive and isometric exercises. Relaxation techniques are used to reduce increased muscle tone and exercises to increase the range of motion in the operated leg. In the third week after the operation, the patient can start to practice stair training. After the stitches from the incision are removed, soft tissue techniques can be implemented (16).

After a total hip replacement there are several important precautions, or contraindicated movements, that the patient needs to be aware of. Adduction of the hip, flexion of the hip above 90°, external rotation are all contraindicated movements and that means that the patient must be careful with movements that can cause dislocation of the hip, such as crossing legs, sitting on low seats or beds, tying shoes with straight knees and side lying positions without support between the knees. The operated extremity can gradually be loaded after guidelines according to the surgeon. Full loading usually occurs between 3-6 months depending on the endoprosthesis and the condition of the patient (5,11).

Before starting the program of rehabilitation, there are important factors to take into consideration such as the type of surgery, type of endoprosthesis, age, level of fitness and other diseases or disorders that can cause limitations (16).

3. Special Part: Case Study

3.1 Methodology

The clinical work placement for this bachelor thesis took place at Fakultní Nemocnice Královské Vinohrady in Prague, Czech Republic, from 18. January 2016 to 29. January 2016 at the department of rehabilitation.

From Monday till Friday, with an average of 8 hours a day, the total amount was 80 hours of clinical work. All my clinical work during this period was done under the supervision of Mgr. Pavla Kvatochvilova.

The patient of this case study is a 59-year-old woman with total replacement of the right hip. She was seven days post-operative when she came to the rehabilitation clinic, and eleven days post-operative the day I met her. The therapy was done mainly in a closed room with two treatment beds with a curtain dividing the room in two. The room was equipped with soft balls, over balls, terra bands, pads and mats with uneven surface and other basic training elements. The therapy was performed from Monday to Friday, two times a day, one session of 45 minutes in the morning, and one session of 30 minutes in the afternoon.

The patient was informed and gave her consent to participate in my clinical work. The Ethics Committee of Charles University, Faculty of Physical Education and Sport, have approved my work with the approval number 038/2016.

3.2 Anamnesis

Name of patient: O, M.

Sex: Female

Date of birth: 31.03.1957

Diagnosis: Total hip replacement (right side)

Code: Z966

Status present:

Replacement of right hip was done 7.01.16. The patient came to the rehabilitation clinic 14.01.16, and she uses underarm (axillary) crutches.

Weight: 59 kg.

Height: 162 cm.

BMI: 22,5

BP: 90/160mmHg.

BPM: 64/min

History of the problem: About three years ago the patient started to feel pain in the right hip. The pain came in periods and heat helped to relief pain. When the patient consulted with a doctor and had several tests done, she was diagnosed with arthrosis in both hips, but it was more severe in the right hip.

Operations:

2016 – Total hip replacement of right hip.

2006 – Operated for carpal tunnel syndrome in both hands.

2004 – Arthroscopic surgery of right knee.

1991 – Cholecystectomy

1983 – Caesarean section.

1977 – Operated for hallux valgus in both feet.

1974 – Meniscectomy of right knee

Prior rehabilitation:

2006: rehabilitation after carpal tunnel surgery in both hands.

1977: rehabilitation after hallux valgus operation in both feet.

1974: rehabilitation after meniscectomy of right knee.

Family history:

The mother had asthma and died at age 54, and the father had liver cirrhosis and died at age 58.

Medications:

Ortanol 20mg

Oxazepam 10mg

Zyrtec 10mg

Fraxiparine 0,4ml/24h

Analgesics.

Gynecological anamnesis: 3 pregnancies – 2 natural births, 1 caesarean section.

Menopause at age 47.

Allergies: penicillin, insect bites.

Abuses: the patient smokes 10 cigarettes a day and drinks occasionally alcohol.

Hobbies: swimming, walking, aerobics and grooming of the garden of her house.

Occupation: the patient lost her job in October 2015, and is now unemployed.

Social anamnesis: the patient lives in a house with her husband. The house has two floors and 7 stairs for each floor.

Indications for rehabilitation:

- Positioning/ verticalization
- Active and passive movement of the hip
- Mobilization of peripheral joints
- Conditioning exercises for upper extremity
- Isometric exercises for abdominal-, and thigh muscles
- Passive motor splint for right hip
- Use of stationary bicycle, rotoped
- Soft tissue techniques for the scar

3.3 Initial kinesiological examination (Date: 18.01.16)**3.3.1 Observation**

The patient is standing up with the support of underarm crutches. The right hip is operated and has a 20cm long plaster covering the anterolateral part of the right hip and thigh. The skin around the area is slightly red. The right knee is semi flexed and the patient is leaning over to the left side for support. The pelvis is tilted laterally towards the right side. In standing position the patient has a kyphotic posture with protruded shoulders and slight hyperextension of the neck.

3.3.2 Postural examination (According to Kendall)

Anterior view:

- Narrow base of support
- Puts more weight on the left foot
- Slight valgosity of the ankles
- Valgosity of both knees
- Left knee is extended
- Right knee is semi flexed
- Pelvis is tilted laterally to the right side
- Umbilicus is slightly shifted towards the left side
- Clavicles are symmetrical
- Shoulders are protruded and in internal rotation
- The head is shifted to the left side

Posterior view:

- Narrow base of support
- Valgosity of ankles
- Achilles tendon is more prominent on the right leg
- Left knee is extended
- Right knee is semi flexed
- Pelvis is tilted laterally towards the right side
- Slight hyperextension of lumbar spine
- Kyphosis of thoracic spine
- Left scapula is higher than the right
- Slight hyperextension of cervical spine
- The head is shifted to the left side

Lateral view (left side):

- Neutral position of the ankle
- Lateral malleolus is visible
- Extension of left knee
- Slight anterior tilt of the pelvis
- Slight hyperlordosis of lumbar spine
- Kyphosis of thoracic spine
- Protrusion of the left shoulder
- Head in forward position

Lateral view (right side):

- Neutral position of the ankle
- Lateral malleolus is visible
- Semi flexion of right knee
- Slight anterior tilt of the pelvis
- Slight hyperlordosis of lumbar spine
- Kyphosis of thoracic spine
- Protrusion of the right shoulder
- Head in forward position

3.3.3 Palpation of pelvis

(Examined in standing position)

Anterior superior iliac spines (ASIS): The left ASIS is higher.

Posterior superior iliac spines (PSIS): The left PSIS is higher.

Iliac crests: Higher in left side.

The patient has slight anterior tilt, comparing PSIS and ASIS on both sides.

3.3.4 Neurological examination

Higher functions and position of sense:

- Higher functions: include speech, memory and mental status. Higher functions in the patient are physiological.
- Position of sense: The individual's cognitive sense of his or her orientation in time, place and person. The position of sense in the patient is physiological.

Light touch

Table 2: Sensation of dermatomes in lower extremities.

Dermatome	Right	Left
L2	Physiological	Physiological
L3	Physiological	Physiological
L4	Physiological	Physiological
L5	Physiological	Physiological
S1	Physiological	Physiological
S2	Physiological	Physiological

Deep tendon reflexes

- Patellar tendon (L2-L4): The right patellar tendon reflex is not tested because of discomfort in the knee. The patellar reflex in the left knee is normal.
- Achilles tendon (L5-S2): Reflexes of both tendons are normal.

Pain

Table 3: Sensation of pain in lower extremities

Dermatome	Right	Left
L2	Pain on lateral thigh	No pain
L3	Pain on lateral thigh	No pain
L4	No pain	No pain
L5	No pain	No pain
S1	No pain	No pain
S2	No pain	No pain

3.3.5 Anthropometric measurements

Table 4: Anthropometric measurements

Anthropometric measurements	Right	Left
Functional length	85 cm	84 cm
Circumferences		
Thigh (15 cm above the knee)	49 cm	48 cm
Knee (around patella)	37 cm	34,5 cm
Under the knee	32,5 cm	31 cm
Around the calf	35 cm	35 cm
Around the ankle	30 cm	30 cm
Around metatarsal head	23,5 cm	23,5 cm

3.3.6 Range of motion

Table 5: Range of motion

Hip joint	Right: Active/passive	Left: Active/passive
Flexion	45°/55°	120°/130°
Extension	0°/5°	10°/10°
Abduction	5°/20°	30°/40°
Knee joint		
Flexion	70°/70°	115°/120°
Extension	0°/0°	0°/0°

3.3.7 Palpation of muscles and examination of skin

Table 6: Palpation of muscles and examination of skin

Muscle	Right	Left
Iliopsoas	Hypertone	Normal tone
Rectus femoris	Hypertone	Normal tone
Vastus lateralis	Normal tone	Normal tone
Vastus intermedius	Normal tone	Normal tone
Vastus medialis	Normal tone	Normal tone
Adductors of hip (adductor magnus, adductor longus, adductor brevis, gracilis, pectineus)	Hypertone	Hypertone
Tensor fascia lata	Normal tone	Normal tone
Gluteus maximus	Hypotone	Normal tone
Biceps femoris	Normal tone	Normal tone
Semitendinosus	Normal tone	Normal tone
Semimembranosus	Normal tone	Normal tone
Quadratus lumborum	Hypotone	Normal tone
Triceps surae	Normal tone	Normal tone
Skin of the anterolateral part of the thigh	A bandage is covering the scar, approx. 20 cm on the anterolateral part of the thigh. The skin around is slightly red, with increased temperature, and slight pain by touch.	No hyperalgetic zones, no pain, no restrictions. Normal color and temperature.
Subskin and Fascia of anterolateral part of the thigh	Restrictions in all directions in superficial and deep layers of the thigh.	No restrictions, no pain.

3.3.8 Length tests (According to Kendall)

Table 7: Length tests

Length tests	Right	Left
Hip flexors one-joint muscles	Limited	Normal
Hip flexors one-joint muscles	Limited	Normal
Hamstrings	Normal	Normal
Adductors (<i>according to Janda</i>)	<i>Grade 2</i>	<i>Grade 1</i>
Gastrocnemius and plantaris	Limited	Normal
Soleus and popliteus	Limited	Normal

3.3.9 Strength tests (Grading according to Kendall)

Table 8: Strength tests according the Kendall

Muscle	Right	Left
Iliopsoas	2+	5
Quadriceps femoris	3	4+
Hamstrings	3	4+
Gluteus maximus	2	4+
Hip abductors	2	4
Tibialis anterior	4	5
Soleus	4	5

3.3.10 Joint play examination (According to Lewit)

Table 9: Joint play examination

Joint	Right	Left
Patella	Free	Free
Fibular head	Restricted in ventral and dorsal directions.	Restricted in ventral and dorsal directions.
Subtalar	Free	Free
Talocrural	Free	Free
Choparts	Free	Free
Lisfranc's	Free	Free

MTP	1st	Restricted in dorsal direction	Restricted in dorsal direction
	2nd	Restricted in dorsal direction	Restricted in dorsal direction
	3rd	Restricted in dorsal direction	Restricted in dorsal direction
	4th	Restricted in dorsal direction	Restricted in dorsal direction
	5th	Restricted in dorsal direction	Restricted in dorsal direction
PIP	1st	Free	Free
	2nd	Free	Free
	3rd	Free	Free
	4th	Free	Free
	5th	Free	Free
DIP	2nd	Free	Free
	3rd	Free	Free
	4th	Free	Free
	5th	Free	Free

3.3.11 Movement patterns

Hip extension

The patient initiates the movement by first activating spinal extensors and then hamstrings. The activation of gluteus maximus is decreased and delayed, which is a sign of altered pattern.

Hip abduction

The patient is able to perform the movement with assistance from the therapist. The movement of this pattern is not fluent and the patient is having difficulty keeping the leg in neutral position. The patient has a tensor mechanism of the movement, with compensatory hip flexion and activation of quadratus lumborum in the beginning of the movement.

Trunk curl-up

The patient has an altered pattern in this movement, where she uses predominantly the iliopsoas muscle over the abdominal muscles. The minimal movement of curling and the using of straight back and anterior tilting of the pelvis can establish the weak abdominal muscles.

3.3.12 Gait examination

- Underarm crutches
- “Swing-to gait”, 3-point
- Narrow base of support
- Short step length
- Puts weight only on the left leg
- Semi flexion of the right knee throughout the whole gait cycle.
- Small extension of hip
- Stiff trunk
- Protruded shoulders
- The patient looks down to her feet (not in front of her).

3.3.13 Examination of the scar

Covered by a plaster, and can not be examined at this time (18.01.16)

(Stitches were removed 21.01.16, and examined on 22.01.16, see therapy).

3.3.14 Conclusion of initial kinesiological examination

During observation I saw that the patients posture is poor and kyphotic. The patient has been operated for hallux valgus on both feet (1977), which has caused valgosity of the ankles. She also has been troubled with the right knee, one meniscectomy (1974) and several knee dislocations. She also has valgosity of both knees. The patient feels discomfort in the right knee during flexion over 70°, as if the knee will dislocate and she did not allow testing of the patellar reflex due to that reason. The right hip has been operated for coxarthrosis and the approach for the total hip replacement is anterolateral. The scar is covered by a plaster, and stitches are expected to be removed within a few days.

To compensate for the weak and painful right leg, the patient leans over to the left side, hanging on the crutches for support. The pelvis is tilted laterally to the right side and she has slight anterior tilt of the pelvis. The muscles surrounding the hip and thigh, the quadratus lumborum, quadriceps femoris, hamstrings, gluteus maximus, adductors and abductors are weaker than the left leg, which is because of the newly operated hip. There is weakness and flexion of the trunk, which contributes to the kyphotic posture, this leads to change in the position of the shoulders, which are protruded and in internal rotation. This leads further to hyperextension of the neck and forward position of the head.

The gait of the patient is influenced by not being educated and corrected with underarm crutches after the operation. She has a 3-point gait with a small step length and with small extension of the hip. Her base of support is narrow and makes her unstable during gait and in standing position.

As expected after this type of operation, the muscle of the hip and thigh become weak, and there is a little swelling around the thigh and knee. The range of motion becomes limited and the patient compensates for painful positions and movements by creating a bad posture in standing and during gait. Another reason why the posture is faulty is because the patient has not been educated and instructed on how to use the underarm crutches correctly.

3.4 Rehabilitation plan

3.4.1 Short-term rehabilitation plan

- Deep vein thrombosis (DVT) prevention
- Decrease edema
- Soft tissue techniques for the scar
- Mobilization of blocked joints
- Increase range of motion (ROM) in hip joint
- Relax hypertonic muscles
- Increase strength of weakened muscles
- Stretching of shortened muscles
- Improve stability

3.4.2 Long-term rehabilitation plan

- Improve gait
- Improve movement pattern of the hip
- Increase strength of weakened muscles
- Increase ROM in hip joint
- Achieve full, balanced load in lower extremities in standing and walking
- Improve self-sufficiency in activities of daily living
- Improve overall physical fitness
- Spa

3.5 Day-To-Day Progress

3.5.1 Day 1, first session

Date: 18.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient has no pain in her operated hip today, but feels that the operated leg (right) is longer than the left.

Status present, objective: It's 11 days since the operation. The patient looks good and is energetic. The functional length is measured to check the leg length and the right leg is 1cm longer than the left. There is hypertone of hip adductors, weakness of hip flexors and abductors in the operated hip.

Goal of therapy: The goal will be to relax hypertonic adductors with post-isometric relaxation (PIR), strengthen quadriceps femoris muscles as well as abductors of the hip.

Implementation of therapy

1. PIR of hip adductor muscles (mm.)

Position: supine. Fixation: hip of treated side.

The therapist abducts the leg to the maximal length of the adductor muscles, and holds the leg while the patient gives resistance in the direction of adduction. The patient keeps the resistance for 10 seconds, breathes deeply in and out, and relaxes.

Repetitions: 4.

2. Knee extension

Position: supine. An over-ball is placed under the knee and the patient tries to push the ball downwards, extending the knee. Repetitions: 10.

3. Hip flexion

Position: supine. An over-ball is placed under the heel, with the knee extended. The patient tries to bend the knee while controlling the ball, flexing the hip.

Repetitions: 10.

4. Hip abduction

Position: supine. Active movement of the hip in direction of abduction. The patient moves the leg along the treatment table with dorsal flexion of the ankle.

Repetitions: 10.

Result of therapy: This was the first time Mgr. Kvatochvilova and I met the patient, and half of the session was spent talking about the patient's history and some tests for orientation. The patient had no pain during therapy and performed the exercises well.

No improvement in hip abduction after PIR in the end of the therapy session. Good control and activation of muscles during hip flexion and knee extension. Active abduction of the operated hip is difficult for the patient and the movement is not fluent.

3.5.2 Day 1, second session

Date: 18.01.16 **Therapy #2 (30 minutes)**

Status present, subjective: The patient has no complaints or pain, and is ready for her second therapy of the day.

Status present, objective: The patient is still in good mood as she was earlier in the morning. A quick assessment shows hypertone of iliopsoas muscle and rectus femoris. The rectus femoris and gluteus maximus muscles are weak and the ROM in the knee is only 70° during active movement.

Goal of therapy: Today's goal is to exercise in side lying and prone position, relaxing the hypertonic iliopsoas and rectus femoris muscles, increase ROM in hip and knee joint, and increase strength of hip extensors.

Implementation of therapy

1. PIR of iliopsoas muscle (m.)

Position: side lying. Fixation: sacrum.

The patient is lying with the operated side up, with a pillow between the legs for support. The therapist stands behind the patient, holding the leg in a supported position and bring the hip into extension. The patient gives resistance in direction of hip flexion and holds it for 10 seconds before breathing deeply in- and out, and relaxes. Repetitions: 3.

2. PIR of rectus femoris m.

Position: prone. The patient is lying with the knee flexed and the therapist bends the knee till the stretch is felt. The patient gives resistance in direction of extending the knee and holds it for 10 seconds. The patient breathes deeply in- and out and relaxes. Repetitions: 3.

3. Hip extension

Position: prone. A pillow is placed under the ankles of the patient for support, with only the knees and toes touching the treatment table. The patient activates the gluteal muscle and hamstrings to extend the hip with extended knee. Repetitions: 3.

4. Knee flexion

Position: prone. Active movement, starting position is with the knees extended on the treatment bed and a small pillow under the ankles for support. The patient bends the knee as much as possible, trying to increase ROM in the knee joint. Repetitions: 10.

Result of therapy: The patient felt release after PIR for iliopsoas m., but PIR of rectus femoris m. was not successful due to discomfort during flexion of the knee. The active exercise of knee flexion was performed until the point where the patient was experiencing discomfort. She was able to complete all exercises.

3.5.3 Day 2, first session

Date: 19.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient is experiencing pain in the lumbar area, paravertebral muscles and discomfort in the upper thoracic area when she is breathing in- and out. She is also feels tired/fatigue in the operated leg.

Status present, objective: It's 12 days since the operation and the patient looks tired and less motivated than the day before. Soft tissues of lumbar and thoracic area are examined, and show restrictions in dorsal and caudal direction. The paravertebral mm. and iliopsoas m. of the operated hip are hypertonic.

Goal of therapy: Because of the discomfort in lumbar and thoracic area, we will try to release the tension and also relax the hypertonic iliopsoas with PIR. The goal will also be to increase strength of the trunk and operated leg using active and isometric exercises. We will continue to practice knee flexion of the right leg to increase the ROM.

Implementation of therapy

1. Soft tissue techniques (according to Lewit)

Position: prone. Shifting and stretching of dorsal fascia in cranial and caudal direction. Shifting of deep lumbar fascia in caudal direction. Duration: 10 minutes.

2. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

3. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

4. Isometric exercise for lower extremity

Position: prone. The patient is lying flat on the treatment bed with one knee flexed at 90° and dorsal flexion of the ankle. The therapist puts light pressure on the medial and lateral part of the heel, and behind the heel. The patient tries to keep the foot in the same position at all times. Repetitions: 2 sets of 30 seconds.

5. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

6. Trunk stability

Position: side lying. The patient is lying with the whole body in one line and with the operated side up. The therapist puts pressure on different parts of the body, anterior and posterior side of the shoulder- and of the hip. The patient tries to keep the body as stable as possible. Repetitions: 2 sets of 30 seconds.

7. Hip abduction

Position: side lying. The patient is lying with the operated side up and a pillow is placed between the legs to avoid adduction of the operated hip. The patient tries to raise the leg against gravity. Repetitions: 10.

Result of therapy: The patient felt relaxed in the lumbar and thoracic area after soft tissue techniques and there was improved mobility of the soft tissues at the end of the therapy session. During knee flexion in prone position, the patient was able to perform the exercise without pain and she was able to increase the ROM from 70° to 80°. Trunk stability and hip abduction in side lying position was challenging for the patient, she was unstable at times and after the therapy she was tired from all the exercises.

3.5.4 Day 2, second session

Date: 19.01.16

Therapy #2 (30 minutes)

Status present, subjective: The patient feels improvement in the lumbar and thoracic area after the morning session, and she feels relaxed in the whole body. No pain.

Status present, objective: The patient is 10 minutes late for therapy because she was sleeping. She is sleepy, but her mood is good. There is still hypertone of adductors.

Goal of therapy: Today's goal is to relax hypertonic adductors with PIR, increase general strength of lower extremity by active and isometric exercises.

Implementation of therapy

1. PIR of hip adductor mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 3.

2. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

3. Isometric exercise for lower extremity

Position: supine. An over-ball is placed under the patient's heel with the knee extended. The therapist puts light pressure on the medial and lateral part of the heel. The patient tries to keep the leg as stable as possible. Repetitions: 2 sets of 30 seconds.

4. Bridging on uneven surface

Position: supine. The patient is lying with the knees flexed and with the feet placed on a mat with uneven surface. An over-ball is placed between the knees for support. She then raises the pelvis of the treatment table and holds the position for 5-10 seconds. Repetitions: 10.

5. Knee extension

Position: sitting. The patient is sitting on the treatment bed with the feet placed on the floor. The patient actively extends the knee and then places it back on the floor. Repetitions: 10.

Result of therapy: After therapy there was increased ROM in abduction of the operated hip. The patient had good control of her pelvis in bridging, and felt tension in the rectus femoris m., but performed all exercises without pain or discomfort.

3.5.5 Day 3, first session

Date: 20.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient feels pain in the neck and upper thoracic area, but has no pain in the operated hip and feels strong.

Status present, objective: It's 13 days since the operation. Soft tissues of the upper thoracic and neck area are examined and show restrictions in cranial and caudal direction, and hypertone is found of trapezius m. on both sides. Hip adductor mm. are also in hypertone.

Goal of therapy: Today's goal is to reduce tension in the soft tissues of thoracic and neck area, as well as relaxing the hypertonic trapezius m. and adductors with PIR. The goal will also be to increase the general strength of the operated leg as well as increase the range of motion in the hip joint.

Implementation of therapy

1. Soft tissue techniques

Position: prone. Shifting and stretching of dorsal fascia in cranial and caudal direction. Rotational movement for fascia of the neck. Gentle massage for neck extensors.

2. PIR of hip adductor mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 3.

3. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

4. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. Isometric exercise for lower extremity

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 2 sets of 30 seconds.

6. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

7. Bridging with feet on an uneven surface

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 10.

8. Bridging with feet on air pillow

Position: supine. The patient is lying with the knees flexed and with the feet placed on a pillow filled with air. The patient elevates the pelvis and keeps the position for 5-10 seconds. Repetitions: 10.

9. Hip flexion with a big yoga ball

Position: supine. The patient is lying with the feet flexed on a big yoga ball and tries to move up and down with the ball on the treatment bed, flexing the hip.

Repetitions: 10.

10. Knee extension with a big yoga ball

Position: supine. The patient is lying with the feet flexed on a big yoga ball and tries to extend the knees by pushing the ball down to the treatment bed. Repetitions: 10.

Result of therapy: After therapy the length of hip adductors was increased and the patient had full ROM in hip abduction. The patient was challenged with difficult exercises and managed to perform them well. Her strength of the operated leg had increased and the patient was happy to see that her training has effect on her strength.

3.5.6 Day 3, second session

Date: 20.01.16

Therapy #2 (30 minutes)

Status present, subjective: The patient is feeling cold and weak today.

Status present, objective: The patient looks tired, her body temperature is normal (36,8°), and she wants to exercise. Iliopsoas and rectus femoris muscles of the right side are still hypertonic, and the flexion of the right knee is limited (80°)

Goal of therapy: Today's goal is to relax the hypertonic iliopsoas and rectus femoris muscles with PIR, and strengthen the trunk and lower extremity with isometric and active exercises. We will work on increasing the ROM in the right knee.

Implementation of therapy

1. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

2. Hip abduction

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 10.

3. Trunk stability

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

4. PIR of rectus femoris m.

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. 3.

5. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

6. Isometric exercise for lower extremity

Position: prone. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

7. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

Result of therapy: Ms. O feels pain during the isometric exercise of lower extremity when activating the external rotators of the operated side. During knee flexion the patient is hesitant to bend the knee beyond over 90°, because of the history of knee dislocations. PIR of rectus femoris m. allows flexion in the right knee to 90°, which is an improvement. The iliopsoas is relaxed after therapy. The rest of the exercises were performed without any problem.

3.5.7 Day 4, first session

Date: 21.01.16

Therapy #1 (45 minutes)

Status present, subjective: Mrs. O is feeling tired from yesterdays activities. She has got a cold and she has a headache. She complains of pain in the neck, shoulders and paravertebral muscles. She is cleared to exercise by the doctor since she doesn't have a fever.

Status present, objective: It's 14 days since the operation. Examination of soft tissues and palpation of neck, shoulders and paravertebral muscles show increased tension and there is still hypertone of adductors of the right hip.

Goal of therapy: Release tension from neck, shoulders and paravertebral muscles with hot roll application, relax hypertonic adductor muscles with PIR, improve stability of the trunk, and increase ROM and strength in lower extremity.

Implementation of therapy

1. Hot roll application (with towel)

Position: prone. Hot roll application for paravertebral muscles, neck and shoulders.

Duration: 10 minutes.

2. PIR of hip adductor mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 3.

3. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

4. Isometric exercise for lower extremity

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 2 sets of 30 seconds.

5. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

6. Hip flexion (passive)

Position: supine. An over-ball is placed under the heel, with the knee extended. The therapist moves the leg passively into flexion until the pain barrier is reached.

Repetitions: 10.

7. Hip flexion (active)

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

8. Bridging on uneven surface

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 10.

9. Bridging on air pillow

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

Result of therapy: The status of the patient did not affect the therapy, she had no pain, and she felt release after the hot roll application. The stiffness in rectus femoris muscle of the right leg has improved since yesterday. PIR of adductors were successful today, the patient had full ROM in hip abduction during passive

movement. The stability of pelvis has also improved in the bridging exercises, she can hold her pelvis stable and corrects it by her self when she starts to get tired.

3.5.8 Day 4, second session

Date: 21.01.16 **Therapy #2 (30 minutes)**

Status present, subjective: Ms. O has not been sleeping well and is feeling tired and exhausted. She says that the situation in her room is complicated and she is wakes up form other patients snoring during the night.

Status present, objective: The patient looks tired and frustrated. The stitches have been removed, but the small incisions are not completely healed and have several small scabs. There is tension in the right rectus femoris muscle and the flexion of the right knee is limited.

Goal of therapy: Today´s goal is to repeat previous exercises, relax the hypertonic rectus femoris and increase ROM in the knee joint. We will also work with the whole lower extremity in isometric exercises.

Implementation of therapy

1. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

2. PIR of rectus femoris m.

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

3. Isometric exercise for lower extremity

Position: prone. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

4. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

5. Isometric exercise for lower extremity

Position: sitting. The patient is sitting on the edge of the treatment table with the feet touching the floor. One foot is placed on a square pillow for support, while a ball is placed under the other leg. The therapist pulls the ball in different direction while the

patient is trying to keep the ball from moving too much. Repetitions: 2 sets of 30 seconds.

Result of therapy: There was no improvement of ROM in knee joint today, but the patient performed active flexion till the point of pain. Decreased tension in rectus femoris m. and the isometric exercises were performed well.

3.5.9 Day 5, first session

Date: 22.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient is experiencing pain in the right knee, but no pain in the operated hip.

Status present, objective: It's 15 days since the surgery.

Examination of the scar: The scar is approximately 14 cm long. The incision of the scar is healing well and has a light pink color. The small scars from the sutures are red and are the warmest part of the scar. There is some restrictions and edema that is harder to palpate and it is located in the area of the middle till the distal end of the scar. The skin surrounding the scar is light red, dry and slightly warmer than other tissues.

Examination of adductors, rectus femoris and iliopsoas muscles show hypertone.

Goal of therapy: The goal is the use soft tissue techniques for the scar on the anterolateral part of the right thigh, relax all the hypertonic muscles with PIR, and increase strength by active and isometric exercises in lower extremity of the operated leg.

Implementation of therapy

1. Soft tissue techniques

Position: supine. Soft tissue techniques for the scar on the anterolateral part of the right thigh, pressure applied in all directions towards the scar. Duration: 10 minutes.

2. PIR of hip adductors

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 3.

3. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

4. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

6. Hip abduction

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 10.

7. Trunk stability

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

8. PIR of rectus femoris m.

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

9. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

10. Isometric exercise for lower extremity

Position: prone. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

11. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

Result of therapy: The patient felt some pain in the scar during soft tissue techniques because of swelling. During therapy for the scar the distal area of the scar was more restricted than the rest of the scar. The rest of the scar is movable, but also restricted in all directions. Reduced tension after PIR in adductors, iliopsoas and rectus femoris muscles. Strengthening exercises were performed well and correctly.

3.5.10 Day 5, second session

Date: 22.01.16

Therapy #2 (30 minutes)

Status present, subjective: The patient is excited to learn how to walk stairs, and feels good. The pain in the knee from this morning is better.

Status present, objective: The patient looks healthy and is in good shape. When the patient is walking with underarm crutches, she is not using the operated leg, the knee is semi flexed and she has no extension in the hip. When she is climbing stairs she does it very fast without considering the position of the hips and knees. when walking down she is unstable and has internal rotation of both hips.

Goal of therapy: Correction of gait with crutches, she will try to place the right leg on the floor when walking and extend the hip in both hips. She also will be careful with the loading on the right leg. The goal will also be to correct the patient in the stairs, to avoid dangerous positions of the hip and knees and to be more stable and confident in the movements.

Implementation of therapy

1. Gait

The patient is using underarm crutches and walks with little extension of the hip and with a forward posture hanging over the crutches. Straightening the trunk, relaxing her shoulders, extending the neck and lifting the head to see in front of her correctly. She is also instructed to use the operated leg in the gait cycle but with little weight bearing.

2. Climbing stairs

Instructions for underarm crutches: Healthy leg – operated leg – crutches.

3. Descending stairs

Instructions for underarm crutches: crutches – operated leg – healthy leg.

Result of therapy: The patient is climbing stairs in a rapid tempo, and it influences her posture and control of the movement. Descending stairs is more difficult for the patient because she is knocking knees when taking the first step down. She was able to understand and to correct her self when slowing down both the gait and walking in stairs. After therapy she feels a little dizzy due to low blood pressure.

3.5.11 Day 8, first session

Date: 25.01.16

Therapy #1 (45 minutes)

Status present, subjective: Mrs. O feels good, she feel improvement in mobility of the operated leg. It's easier to move around and during the weekend she practiced gait and walking in stairs. She also has a ball in her room that she did exercise with on her own time.

Status present, objective: It's 18 days since the surgery. The scar is irritated where the stitches were attached. The incision is light pink in color and looks fine.

Hypertone is found in hip adductors and iliopsoas muscles of the right side.

Goal of therapy: Today's goal is soft tissue techniques for the scar on the anterolateral part of the right thigh to increase the mobility of the scar, relax the hypertonic iliopsoas and adductor muscles with PIR, increase ROM in the knee and hip joint and to increase the strength and stability of the trunk and right lower extremity with active and isometric exercises.

Implementation of therapy

1. Soft tissue techniques

Position: supine. Soft tissue techniques for the scar on the anterolateral part of the right thigh, pressure applied in all directions towards the scar. Duration: 10 minutes.

2. PIR of hip adductor mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 4.

3. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

4. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. Isometric exercise for lower extremity

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 2 sets of 30 seconds.

6. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

7. Bridging

Position: supine. The patient is lying with the knees flexed. The patient elevates the pelvis and keeps the position for 5-10 seconds. Repetitions: 10.

8. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 4.

9. Hip abduction

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 10.

10. Trunk stability

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

Result of therapy: The scar mobility is better today, but the edema on the distal end is still painful for the patient. The tone of iliopsoas and adductor muscles was reduced, and the patient performs strengthening exercises with very good control and she is confident and knows what to do in the exercises.

3.5.12 Day 8, second session

Date: 25.01.16

Therapy #2 (30 minutes)

Status present, subjective: Mrs. O is feeling energetic and has no pain. She is worried about her scar, since it's been itching and it's a little red.

Status present, objective: The scar's suture incisions are still red and looks irritated, so we are not going to perform any soft tissue techniques until she has consulted her doctor. The patient was exercising in the stairs of the hospital during the weekend and it will be controlled during therapy. The flexion of the knee is still limited to 90°, and there is tension of m. rectus femoris of the right side.

Goal of therapy: The goals of today's therapy will be to control walking up and down stairs, relax the hypertonic rectus femoris m. with PIR and to increase ROM in knee, and increase strength of hip extensors.

Implementation of therapy

1. Climbing and descending stairs with crutches

2. PIR of rectus femoris m.

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

3. Knee flexion with 0,5kg ankle-weight.

Position: prone. The patient bends the knee until approximately 90° and then goes back to starting position. Repetitions: 10.

4. Isometric exercise for lower extremity

Position: prone. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

5. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

Result of therapy: Ms. O is better at walking stairs, and during the weekend she became more confident and can control the movement of climbing and descending stairs. There are only small corrections when it comes to the tempo she has, because she tends to walk a little fast and then she forgets to control the position of her hips and knees. The patient performed an exercise with ankle-weight and she had good activation of hamstrings and gluteal muscle.

3.5.13 Day 9, first session

Date: 26.01.16

Therapy #1 (45 minutes)

Status present, subjective:

Status present, objective: It's 19 days since the operation. The suture incision of the scar is still has some red spots but the main incision looks light pink. The adductor and iliopsoas muscles of the hip are hypertonic.

Goal of therapy: Relax the hypertonic muscles adductor and iliopsoas muscles with PIR, increase the stability of the trunk and operated leg, as well as increase ROM and strength of the operated leg with both active and isometric exercises-.

Implementation of therapy

1. PIR of hip adductors mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 3.

2. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

3. Isometric exercise for lower extremity

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 2 sets of 30 seconds.

4. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day.

Repetitions: 10.

6. Bridging on uneven surface

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 10.

7. Bridging on air pillow

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

8. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

9. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 4.

10. Trunk stability

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

11.Hip abduction

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 10.

Result of therapy: No therapy for the scar due to the irritation. The doctor will have a look at it later this afternoon. It was difficult for the patient to elevate the leg during hip flexion in the beginning of the exercises. She is able to do hip flexion up to 90° actively after 1-2 times with help, which is the full ROM she is allowed to have at this moment after the operation.

3.5.14 Day 9, second session

Date: 26.01.16 **Therapy #2 (30 minutes)**

Status present, subjective: The patient is excited and motivated to try the stationary bicycle. No pain in the operated hip.

Status present, objective: The patient looks good, since her ROM in hip flexion is 90°, we will try the stationary bicycle.

Goal of therapy: Improve walking in stairs and the physical condition of the patient.

Implementation of therapy

1. Stationary bicycle

Duration: 5 minutes.

Watt: 26

Speed: 5-7 km/h

2. Climbing stairs

4 floors, 16 steps in each floor.

Result of therapy: The patient had to be reminded to slow down the tempo in the stairs, and also be aware of the position of the feet and to keep the knees pointing forward.

3.5.15 Day 10, first session

Date: 27.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient is tired from sleeping poorly.

Status present, objective: It's 20 days since the operation. The patient has been exercising on the stationary bicycle as well as practicing stair climbing on her own since yesterday. Adductors and iliopsoas muscles of the right side are still in hypertone.

Goal of therapy: relax the hypertonic adductors and iliopsoas muscles using PIR, increase ROM in hip joint, and strengthen muscles of trunk and lower extremity with active and isometric exercises.

Implementation of therapy

1. PIR of hip adductor mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 4.

2. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

3. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

4. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. Bridging

Position: supine. The exercise is performed the same way as described in the first therapy of the eight day. Repetitions: 10.

6. Bridging with extension of knee

Position: supine. The patient is lying with the knees flexed and with the feet placed on a mat with uneven surface. An over-ball is placed between the knees for support. She then raises the pelvis of the treatment table and holds the position while extending one knee. Repetitions: 6.

7. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

8. Trunk stability

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

9. Hip abduction

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 10.

10. Knee extension

Position: sitting. The patient is sitting on the treatment bed with the feet placed on the floor. The patient actively extends the knee and then places it back on the floor.

Repetitions: 10.

Result of therapy: Performs exercises well with good quality and control. Her strength in the operated leg is increasing every day. A plaster is covering the scar, and the doctor has advised against doing soft tissue techniques.

3.5.16 Day 10, second session

Date: 27.01.16

Therapy #2 (30 minutes)

Status present, subjective: The patient is upset due to living situation at the hospital; she can't sleep during the night due to other patients snoring.

Status present, objective: The patient is not in a good mood and she is sad. The rectus femoris m. is in hypertone and the knee flexion of the right knee is still limited to 90° during active and passive movement.

Goal of therapy: Today's goal will be to relax the hypertonic rectus femoris m. with PIR, increase ROM in knee joint and strengthen muscles of lower extremity with active and isometric exercises.

Implementation of therapy

1. PIR of rectus femoris m.

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

2. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 10.

3. Isometric exercise for lower extremity

Position: prone. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

4. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

5. Hip flexion with big yoga ball

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

Result of therapy: The patient is tired and did not perform the exercises as well as she usually does. She was unfocused and the mood was bad. No soft tissue techniques for the scar. During active movement of knee flexion in prone, she was able to increase the ROM to 100°.

3.5.17 Day 11, first session

Date: 28.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient feels good, has no pain and is ready for exercises.

Status present, objective: It's 21 days since the operation. Today's findings are hypertonic adductors, and iliopsoas muscles.

Goal of therapy: Today's goal is to repeat exercises from previous therapies, relax hypertonic muscles with PIR (iliopsoas m. and adductor mm. of the hip), increase ROM in knee and hip joint and increase strength of the trunk and lower right extremity with active and isometric exercises.

Implementation of therapy

1. PIR of hip adductor mm.

Position: supine. Fixation: hip of treated side. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 4.

2. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

3. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

4. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. Bridging on uneven surface

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 10.

6. Bridging on uneven surface with extension of knee

Position: supine. The patient is lying with the knees flexed and with the feet placed on a mat with uneven surface. An over-ball is placed between the knees for support. She then raises the pelvis of the treatment table and holds the position while extending one knee. Repetitions: 6.

7. Knee extension with a big yoga ball

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

8. Hip flexion with a big yoga ball

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

9. Isometric exercise for lower extremity

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 2 sets of 30 seconds.

10. Bridging with a big yoga ball

Position: supine. The patient is lying with the knees flexed on a big yoga ball, and lifts the pelvis of the treatment bed and holds the position for 5-10 seconds.

Repetitions: 6.

11. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

12. Hip abduction

Position: side lying. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 10.

Result of therapy: Ms. O was focused and performed the exercises with good control and thinks that bridging exercises and exercises with yoga ball are challenging but fun. She is slightly unstable with the big yoga ball, but she has good muscle activation and she likes the exercise. The patient is good range of motion in hip flexion, 90°, and in hip abduction, 30°. The ROM in knee flexion is also improved to 110° with active movement.

3.5.18 Day 11, second session

Date: 28.01.16

Therapy #2 (30 minutes)

Status present, subjective: Mrs. O is complaining of pain in the whole right leg, especially on the lateral side of the knee.

Status present, objective: The patient looks tired and exhausted. The lateral part of the knee is sensitive to touch and the patient feels pain inside the medial and lateral part of the knee joint. Examination of joint play (according to Lewit) shows blocked fibular heads on both feet, in both ventral and dorsal directions. The metatarsal joints are also blocked, but in dorsal direction. There is also hypertone of adductors and rectus femoris muscles.

Goal of therapy: Today's goal will be to reduce pain, focus on mobilization of fibular heads and metatarsal joints, and relax the hypertonic adductors and rectus femoris muscle with PIR.

Implementation of therapy

1. PIR of rectus femoris m.

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

2. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

3. Isometric exercise for lower extremity

Position: prone. The exercise is performed the same way as described in the first therapy of the second day. Repetitions: 2 sets of 30 seconds.

4. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 6.

5. Mobilization of metatarsophalangeal joints (according to Lewit)

Fan-wise spreading of the heads in dorsal direction of both feet.

6. Mobilization of fibular heads (according to Lewit)

Position: supine with semi flexed knees. Mobilization of right and left fibular heads in both dorsal and ventral directions.

7. Stimulation with spike ball under the soles of the feet.

The patient is sitting on the edge of the treatment bed with the feet touching the ground. The patient is rolling her feet up and down on top of a spike ball.

8. Walking with toes forth and back

The patient is sitting on the edge of the treatment bed with the feet touching the ground. She creeps forward and back with the toes by flexing and extending them.

9. Isometric exercise for lower extremity

Position: sitting. The exercise is performed the same way as described in the second therapy of the fourth day. Repetitions: 2 sets of 30 seconds.

Result of therapy: During hip extension the patient was feeling pain in the right hip and she was not able to do more than 6 repetitions. We did not perform PIR of adductors because of the pain in the right knee. Release of blockages in fibular heads in both legs. To avoid provoking pain in the knee, we did exercises to stimulate the feet and active exercises for the toes of the foot.

3.5.19 Day 12, second session

Date: 29.01.16

Therapy #1 (45 minutes)

Status present, subjective: The patient has pain on the lateral part of the knee as she had yesterday.

Status present, objective: Fibular head in the right leg is blocked, and there is hypertone of iliopsoas m.

Goal of therapy: The goal of today's therapy is to mobilize right fibular head, decrease tension in iliopsoas m. with PIR, and to strengthen muscles of lower extremity with active and isometric exercises.

Implementation of therapy

1. Mobilization of fibular head right leg (according to Lewit)

Position: supine. Position: supine with semi flexed knees. Mobilization of right and left fibular heads in both dorsal and ventral directions.

2. Knee extension

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

3. Isometric exercise for lower extremity

Position: supine. The exercise is performed the same way as described in the second therapy of the second day. Repetitions: 2 sets of 30 seconds.

4. Hip flexion

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

5. Hip abduction

Position: supine. The exercise is performed the same way as described in the first therapy of the first day. Repetitions: 10.

6. Hip flexion with a big yoga ball

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

7. Knee extension with a big yoga ball

Position: supine. The exercise is performed the same way as described in the first therapy of the third day. Repetitions: 10.

8. PIR of iliopsoas m.

Position: side lying. Fixation: sacrum. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 3.

9. Knee flexion

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

10. Hip extension

Position: prone. The exercise is performed the same way as described in the second therapy of the first day. Repetitions: 10.

Result of therapy: We did not perform PIR of adductors, or active abduction of the hip because of the painful right knee. The patient was able to do exercises of flexion and extension without pain. Release of blockage in fibular head of right leg. The patient is instructed not to use the bicycle or roped until next week. No scar therapy, its still covered by a plaster.

3.6 Final kinesiological examination (Date: 29.01.16)

3.6.1 Observation

The patient is standing with support of underarm crutches. The operated right hip has a 20 cm long bandage over the anterolateral part of the thigh. **The patient is standing with both feet placed on the floor, but only with 20% loading on the right foot. No visible swelling, and the thigh have normal skin color. The trunk is straight,** and the shoulders are **slightly** protruded but symmetrical. Head is in forward position.

3.6.2 Postural examination (According to Kendall)

Anterior view:

- **Normal base of support**
- Puts more weight on the left foot
- Valgosity of both ankles
- Slight valgosity of the knees
- The pelvis is tilted laterally to the right side
- **Umbilicus is in the midline**
- Clavicles are symmetrical
- Protrusion of the shoulders
- Head in forward position

Posterior view:

- **Normal base of support**
- Valgosity of ankles
- Achilles tendon is more prominent on the right leg
- Left knee is extended
- **Right knee is extended**
- Pelvis is **slightly** tilted laterally towards the right side
- **Lordosis of lumbar spine**
- Kyphosis of thoracic spine
- Left shoulder is **slightly** higher than the right
- **Lordosis of cervical spine**
- **The head is in midline**

Lateral view (left side):

- Neutral position of the left ankle
- Lateral malleolus is visible
- Extension of left knee
- **Lordosis of lumbar spine**
- Kyphosis of thoracic spine
- Protrusion of the left shoulder
- Head is in **slightly** forward position

Lateral view (right side):

- **Whole right foot on the floor, neutral position**
- Lateral malleolus is visible
- **Extension of right knee**
- **Lordosis of lumbar spine**
- Kyphosis of thoracic spine
- Protrusion of the right shoulder
- Head is in **slightly** forward position

3.6.3 Palpation of pelvis

(Examined in standing position)

ASIS: The left ASIS is higher.

PSIS: The left PSIS is higher.

Iliac crests: Higher in left side.

Comparing PSIS and ASIS on both sides, there is no anterior tilt.

3.6.4 Neurological examination

Higher functions and position of sense:

- Higher functions: include speech, memory and mental status. Higher functions in the patient are physiological.
- Position of sense: The individual's cognitive sense of his or her orientation in time, place and person. The position of sense in the patient is physiological.

Light touch

Table 10: Sensation of dermatomes in lower extremities

Dermatome	Right	Left
L2	Physiological	Physiological
L3	Physiological	Physiological
L4	Physiological	Physiological
L5	Physiological	Physiological
S1	Physiological	Physiological
S2	Physiological	Physiological

Deep tendon reflexes

- Patellar tendon (L2-L4): The right patellar tendon reflex is not tested because of discomfort in the knee. The patellar reflex in the left knee is normal.
- Achilles tendon (L5-S2): Reflexes of both tendons are normal.

Pain

Table 11: Sensation of pain in lower extremities

Dermatome	Right	Left
L2	Slight pain on lateral thigh	No pain
L3	Slight pain on lateral thigh	No pain
L4	Slight pain over the knee	No pain
L5	No pain	No pain
S1	No pain	No pain
S2	No pain	No pain

3.6.5 Anthropometric measurements

Table 12: Anthropometric measurements

Anthropometric measurements	Right	Left
Functional length	85 cm	84 cm
Circumferences		
Thigh (15 cm above the knee)	49 cm	48 cm
Knee (around patella)	36 cm	34,5 cm
Under the knee	31,5 cm	31 cm
Around the calf	35 cm	35 cm
Around the ankle	30 cm	30 cm
Around metatarsal head	23,5 cm	23,5 cm

3.6.6 Range of motion

Table 13: Range of motion

Hip joint	Right Active/passive	Left Active/passive
Flexion	90°/90°	120°/130°
Extension	0°/5°	10°/10°
Abduction	20°/30°	30°/40°
Knee joint		
Flexion	120°/120°	120°/120°
Extension	0°/0°	0°/0°

3.6.7 Palpation of muscles and examination of skin

Table 14: Palpation of muscles and examination of skin

Muscle	Right	Left
Iliopsoas	Normal tone	Normal tone
Rectus femoris	Hypertone	Normal tone
Vastus lateralis	Normal tone	Normal tone
Vastus intermedius	Normal tone	Normal tone
Vastus medialis	Normal tone	Normal tone
Adductors of hip (adductor magnus, adductor longus, adductor brevis, gracilis, pectineus)	Normal tone	Hypertone
Tensor fascia lata	Normal tone	Normal tone
Gluteus maximus	Hypotone	Normal tone
Biceps femoris	Normal tone	Normal tone
Semitendinosus	Normal tone	Normal tone
Semimembranosus	Normal tone	Normal tone
Quadratus lumborum	Normal tone	Normal tone
Triceps surae	Normal tone	Normal tone
Skin of the anterolateral part of the anterolateral part of the thigh	A bandage is covering the scar, approx. 20 cm on the anterolateral part of the thigh. Increased temperature and slight pain by touch.	No hyperalgetic zones, no pain, no restrictions. Normal color and temperature.
Subskin and Fascia of the anterolateral part of the thigh	Restrictions in superficial and deep layers of the thigh.	No restrictions, no pain.

3.6.8 Length tests (According to Kendall)

Table 15: Length tests

Length tests	Right	Left
Hip flexors one-joint muscles	Limited	Normal
Hip flexors one-joint muscles	Limited	Normal
Hamstrings	Normal	Normal
Adductors (<i>acc. to Janda</i>)	Grade 1	Grade 0
Gastrocnemius and plantaris	Normal	Normal
Soleus and popliteus	Normal	Normal

3.6.9 Strength tests (According to Kendall)

Table 16: Strength tests according to Kendall

Muscle	Right	Left
Iliopsoas	3+	5
Quadriceps femoris	4	5
Hamstrings	3+	4+
Gluteus maximus	3+	4+
Hip abductors	3	4+
Tibialis anterior	4	5
Soleus	4	5

Table – Muscle strength

3.6.10 Joint play examination (According to Lewit)

Table 17: Joint play examination

Joint	Right	Left
Patella	Free	Free
Fibular head	Free	Free
Subtalar	Free	Free
Talocrural	Free	Free
Choparts	Free	Free
Lisfranc's	Free	Free

MTP	1st	Restricted in dorsal direction	Restricted in dorsal direction
	2nd	Restricted in dorsal direction	Restricted in dorsal direction
	3rd	Restricted in dorsal direction	Restricted in dorsal direction
	4th	Restricted in dorsal direction	Restricted in dorsal direction
	5th	Restricted in dorsal direction	Restricted in dorsal direction
PIP	1st	Free	Free
	2nd	Free	Free
	3rd	Free	Free
	4th	Free	Free
	5th	Free	Free
DIP	2nd	Free	Free
	3rd	Free	Free
	4th	Free	Free
	5th	Free	Free

3.6.11 Movement patterns of the right hip

Hip extension

Altered pattern, the patient uses spinal extensors and hamstrings to initiate the movement, **and the contraction gluteus maximus is present, but decreased.**

Hip abduction

The patient has an altered pattern by using the tensor mechanism, with hip flexion instead of a straight leg raise. **The patient is able to perform the movement without assistance.** The patient is using quadratus to elevate the pelvis and compensating for the lack of muscle strength.

Trunk curl-up

The patient initiates the movement by curling the neck and thoracic spine, but then the movement becomes faulty and there is no curve in the lumbar spine. A straight spine indicates a dominant iliopsoas muscle and weak abdominals.

3.6.12 Examination of gait

- Underarm crutches
- “Swing-to gait”, 3-point
- **Uses the operated leg, but with limited weight bearing**
- **Narrow base of support, but stable**
- **Distributes weight on the two crutches**
- Small extension in hip
- Short step length
- **Straight upper trunk**
- Protruded shoulders
- **Looks in front of her and not down to her feet.**

3.6.13 Examination of scar

The scar is covered and can't be examined.

3.6.14 Conclusion of final kinesiological examination

The final kinesiological examination shows that the patient has improved in several ways. In standing position she is able to place both feet on the floor and extend the right knee. She is confident and stable with the crutches and has a wider base of support than in the initial examination. She has a straight trunk, which makes the pelvis and head in a better position. No anterior tilt, and the lateral tilt is less than initial examination. The shoulders are still protruded, but due to the underarm crutches.

The patient had pain in the right knee on the lateral part during the examinations, but the edema has reduced and the temperature was normal (36,7°). The range of motion in the right knee has increased from 70° to 120° which also makes her more movable and less scared to walk and improved performance in exercises.

The patient improved range of motion in hip joint to 90°, which is the maximum allowable range after total hip replacement at this point. The range of motion in hip abduction also increased to 20° in active movement, which is because both the length and strength of adductor muscles improved and the hypertone reduced. The strength of the right lower extremity improved and the patient was able to perform exercises in different levels of difficulty.

During gait, the patient is using a 3-point, swing to gait, and she uses both of her legs during the gait cycle. The right leg is with minimal loading, but she is able to extend the knee and able to make a little extension in the hip.

During the final examination the patient was experiencing pain in the right knee, on the lateral part and in the operated hip. The examinations were done with gentle touch and some examinations were not comfortable for the patient.

3.7 The effect of therapy

The patient came to the rehabilitation clinic of Fakultní Nemocnice Královské Vinohrady with the goal of rehabilitation after total replacement of the right hip. The main goal was to reduce pain, improve the condition of the muscles surrounding the hip joint by focusing on exercises that includes strength, reduction of muscle tone, passive and active movements, increasing range of motion, stability and function.

The patient was challenged in different way to increase the strength and function of the operated hip. She had good communication with the supervisor, explaining her moods, pains and complications. The patient was motivated and precise in her movements, and did exercises on her own time several times a day at the hospital. The patient had a very positive attitude towards exercises and was easy to work with.

Unfortunately, there was little therapy provided for the scar, which could cause complications for the patient at a later time, but with that being said, the incision was looking good, had a nice pink color and was mobile during the examination and therapy that I performed.

The last day of therapy, the patient was not feeling well. She had pain in her operated hip, and felt pain in the right knee. This situation affected the final kinesiological examination in the way that the patient seems worse, weaker and less motivated than what she was during the last few days before the final examination and throughout this whole process.

If the patient continues to improve her strength, range of motion and physical condition, she will be able to do activities of daily living without any problem. The prognosis is good, but for the future, there may be replacement of other joints such as the right knee and the left hip, and that's why the physical condition of the patient is important and prevention of positions and activities that can damage or injury the joints.

3.8 Conclusion of Special Part: Case Study

During the two weeks of clinical practice at Fakultni Nemocnice Kralovske Vihnohrady, I learned new things every day. My supervisor was very kind; she showed me techniques and exercises that I found useful for the rehabilitation of my patient and for other patients with different diagnoses. She also took good care of me, presenting me to her colleagues and took me around in the hospital to let me experience and see various kinds of patients and therapeutic machines of the rehabilitation clinic.

The patient of this case study was always coming to therapy with a positive attitude towards exercising even though she got a cold and had problems with sleeping during her stay at the hospital. I admire her strength and the effort she gave into the rehabilitation after total hip replacement.

I am satisfied with the result of my case study and appreciate all the guidance and support from the Rehabilitation Clinic at FNKV.

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5. Supplements

5.1 List of tables

General part:

Table 1: Forces on the hip joint

Initial kinesiological examinations:

Table 2: Sensation of dermatomes in lower extremities.

Table 3: Sensation of pain in lower extremities

Table 4: Anthropometric measurements

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Table 6: Palpation of muscles and examination of skin

Table 7: Length tests

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Final kinesiological examinations:

Table 10: Sensation of dermatomes in lower extremities

Table 11: Sensation of pain in lower extremities

Table 12: Anthropometric measurements

Table 13: Range of motion

Table 14: Palpation of muscles and examination of skin

Table 15: Length tests

Table 16: Strength tests according to Kendall

Table 17: Joint play examination

5.2 List of pictures

Picture 1: Bones of the hip joint

Picture 2: Ligamentum teres

Picture 3: Anterior view of iliofemoral and pubofemoral ligament and posterior view of ischiofemoral ligament

Picture 4: Dermatomes of lower extremity

Picture 5: Arteries of hip joint and thigh

Picture 6: Forces on the hip joint

5.3 List of abbreviations

AIIS – anterior inferior iliac spine

ASIS – anterior superior iliac spine

C – cervical spine

DIP – distal interphalangeal joint

DVT – deep vein thrombosis

FNKV – Fakultní Nemocnice Královské Vinohrady

L – lumbar spine

m. – muscle

mm. - muscles

MTP – metatarsophalangeal joint

n. – nerve

PIP – proximal interphalangeal joint

PIR - post-isometric relaxation

PSIS – posterior superior iliac spine

ROM – range of motion

S – sacrum

5.4 Application for Approval by UK FTVS Ethics Committee

UNIVERZITA KARLOVA V PRAZE
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
José Martího 31, 162 52 Praha 6-Vešelavín

Application for Approval by UK FTVS Ethics Committee

of a research project, thesis, dissertation or seminar work involving human subjects

The title of a project: Rehabilitation after total hip replacement
Project form: bachelor
Period of realization of the project: January 2016
Applicant: Mona Skjaanes
Main researcher: Mona Skjaanes
Co-researcher(s):
Supervisor (in case of student's work): PhD. Ivana Vlacilova
Financial support:

Project description: rehabilitation after total hip replacement in a 59-year-old woman, using techniques and methods that aims to improve the range of motion in hip joint, and to increase strength and length of muscles surrounding the hip. The rehabilitation also includes therapy for soft tissues, the scar, how to walk with crutches and education on how to do daily living activities.

Ensuring safety within the research: non-invasive methods are used. Mgr. Pavla Kratochilova will supervise the therapy for rehabilitation.

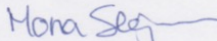
Ethical aspects of the research: The patient is an adult and is non-vulnerable. Data will be anonymized.

Informed Consent: attached

It is a duty of all participants of the research team to protect life, health, dignity, integrity, the right to self-determination, privacy and protection of the personal data of all research subjects, and to undertake all possible precautions. Responsibility for the protection of all research subjects lies on the researcher(s) and not on the research subjects themselves, even if they gave their consent to participation in the research. All participants of the research team must take into consideration ethical, legal and regulative norms and standards of research involving human subjects applicable not only in the Czech Republic but also internationally.

I confirm that this project description corresponds to the plan of the project and in case of any change, especially of the methods used in the project, I will inform the UK FTVS Ethics Committee, which may require a re-submission of the application form.

In Prague, 27.01.16

Applicant's signature: 

Approval of UK FTVS Ethics Committee


The Committee: Chair: doc. PhDr. Irena Parry Martínková, Ph.D.
Members: prof. PhDr. Pavel Slepíčka, DrSc.
doc. MUDr. Jan Heller, CSc.
doc. Ing. Monika Šorfová, Ph.D.
Mgr. Pavel Hráský, Ph.D.
MUDr. Simona Majorová

The research project was approved by UK FTVS Ethics Committee under the registration number: 038/2016
Date of approval: 29.1.2016

UK FTVS Ethics Committee reviewed the submitted research project and found no contradictions with valid principles, regulations and international guidelines for carrying out research involving human subjects.

The applicant has met the necessary requirements for receiving approval of UK FTVS Ethics Committee.

Stamp of UK FTVS


Signature of the Chair of
UK FTVS Ethics Committee

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

5.5 Consent form

UNIVERZITA KARLOVA V PRAZE
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
Josef Martího 31, 162 52 Praha 6-Vešelavín

INFORMOVANÝ SOUHLAS

Vážená paní, vážený pane,

v souladu se Všeobecnou deklarací lidských práv, zákonem č. 101/2000 Sb., o ochraně osobních údajů a o změně některých zákonů, ve znění pozdějších předpisů, Helsinskou deklarací, přijatou 18. Světovým zdravotnickým shromážděním v roce 1964 ve znění pozdějších změn (Fortaleza, Brazílie, 2013) a dalšími obecně závaznými právními předpisy Vás žádám o souhlas s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie prováděné v rámci praxe na¹, kde Vás příslušně kvalifikovaná osoba seznámila s Vaším vyšetřením a následnou terapií. Výsledky Vašeho vyšetření a průběh Vaší terapie bude publikován v rámci bakalářské práce na UK FTVS, s názvem²

Získané údaje, fotodokumentace, průběh a výsledky terapie budou uveřejněny v bakalářské práci v anonymizované podobě. Osobní data nebudou uvedena a budou uchována v anonymní podobě. V maximální možné míře zabezpečím, aby získaná data nebyla zneužita.

Jméno a příjmení řešitele Podpis:.....

Jméno a příjmení osoby, která provedla poučení³ Podpis:.....

Prohlašuji a svým níže uvedeným vlastnoručním podpisem potvrzuji, že dobrovolně souhlasím s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie ve výše uvedené bakalářské práci, a že mi osoba, která provedla poučení, osobně vše podrobně vysvětlila, a že jsem měl(a) možnost si řádně a v dostatečném čase zvážit všechny relevantní informace, zeptat se na vše podstatné a že jsem dostal(a) jasné a srozumitelné odpovědi na své dotazy. Byl(a) jsem poučen(a) o právu odmítnout prezentování a uveřejnění výsledků vyšetření a průběhu terapie v bakalářské práci nebo svůj souhlas kdykoli odvolat bez represí, a to písemně zasláním Etické komisi UK FTVS, která bude následně informovat řešitele.

Místo, datum

Jméno a příjmení pacienta Podpis pacienta:

Jméno a příjmení zákonného zástupce⁴

Vztah zákonného zástupce k pacientovi Podpis: