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Case Study of a Patient after Partial Hip Replacement

Bachelor Thesis

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Abstract

“Case Study of a Patient after Partial Hip Replacement”

The following Bachelor thesis case study took place in Orthopedic Surgery department of the Central Military Hospital in Prague, Czech Republic.

This thesis has been divided in to two section. The first section is a generally theoretical section that describes the lower limb, anatomy, biomechanics, kinesiology and a basic general outlook on the femoral bone fractures and intervention.

The second section which is the practical part of this thesis is focused on the analyses of a patient post a partial hip replacement surgery that's a consequence of a proximal femoral bone fracture. The section contains physiotherapeutic examinations that relate to the patient's condition and help clearly understand her overall clinical picture.

The main goals of therapy approach was to reduce the patient's pain, restore function of the hip and the lower extremity in general to its optimal condition to enable the patient to resume activities of daily living.

There was a positive outcome from the therapies applied. The pain around the hip that the patient used to feel decreased. Greater active and passive ranges of motion in the hip joint were achieved as well. The muscle tonus in the lower extremity also improved significantly. Off course the patient hasn't recovered fully and requires some more time till a full recovery.

Keywords: Arthroplasty, prosthesis, intermedullary nail, proximal fracture, external fixiation, total hip replacement and partial hip replacement.

Declaration

The aim of the study is to apply physiotherapy procedures, to observe and evaluate the results of the rehabilitation therapy used. The methods that are used in the research are based on the knowledge which was obtained during the three year of the bachelor study of physiotherapy program at UK FTVS.

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

The clinical practice for the bachelor thesis was done under the supervision of Bc. Martin Lassner, physiotherapist at the Central Military Hospital in Prague.

Abdullaziz Abdulmalik Ali Abdulmalik

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List of Abbreviations

ADL – Activity of daily living

AROM – Active range of motion

COG – Center of gravity

DVT – Deep vein thrombosis

F – Final

Firm – A strong or springy feeling stop where there is some give as soft tissue, as in a muscle or ligament, stretches when a joint is moved.

Fm – Abductor muscle force

I – Initial

LE – Lower extremity

MB – Muscle belly

MI – Muscle insertion

MO – Muscle origin

MTP - Metatarsophalangeal

PIR – Post isometric relaxation

PROM – Passive range of motion

ROM – Range of motion

R – Ground reaction force

STFR – Sagittal frontal transverse rotational

SIAS – Spina iliaca anterior superior

SIPS – Spina iliaca posterior superior

STT – Soft tissue techniques

UE – Upper extremity

UK FTVS – Fakulta telesne vychovy a sportu Univerzity Karlovy

Wt – Body weight

1. Introduction

The hip joint is one of the most important joints within the human body. It plays a major role in bearing the weight of the entire body and provides a wide range of motion. The joint is supported and stabilized by various muscles. It is common for bone fractures to occur in femur and fractures can occur due to trauma such as falling or due to bone weakening diseases such as osteoporosis. Hip fractures are usually treated through surgery by using screws or in more serious cases via a partial or total hip replacements. The risk of hip fracture increase dramatically with age and it is more prevalent in woman over 65 years.

The main objective of this thesis is to demonstrate, analyze and provide in depth information about the physiotherapeutic intervention and management of a Patient after Partial Hip Replacement due to a proximal femoral fracture.

The practice for this thesis took place at Orthopedic Surgery department of the Central Military Hospital in Prague, Czech Republic, from the 14th of January 2019 till the 25th of January 2019.

2. General part

2.1 Anatomy

2.1.1 The pelvis

The pelvis is made up out of two bones called the “os coxae” or the hip bone, the sacrum and coccyx. The hip bone is made up from 3 bones that are fused together, the ilium superiorly, ishium posteroinferiorly and the pubis anteroinferiorly. (1,2) The iliac crest is a flattened crest on top of the ilium that corresponds to the level of fourth/fifth lumbar vertebra. (3) Going down the iliac crest forward shows a bone projection called the anterior superior iliac spine and inferiorly is the anterior inferior iliac spine. Following the iliac crest posteriorly shows the posterior superior iliac spine and below it is the posterior inferior iliac spine. Below is the greater sciatic notch followed by the notch is the ischial spine and lastly the lesser sciatic notch. (1,2)

2.1.2 The femur

The femoral angle of torsion or the femoral neck anteversion refers to the orientation of the femoral neck in relation to the femoral condyles at the level of the knee. In most cases, the femoral neck is oriented anteriorly as compared to the femoral condyles. In the case of posterior orientation, the term femoral retroversion is also applied. (4) The value of femoral neck anteversion angle at birth is commonly about 40 degrees and decreases gradually to approximately 20 degrees by the age of 10 years old, to finally achieve value around 8 to 15 degrees in adulthood. If the angle of anteversion is greater than 20 degrees it is considered excessive femoral anteversion, whereas a torsion angle of less than 10 degrees is considered femoral retroversion. (5)

The femoral angle of inclination or the neck shaft angle is the angle formed by axis of femoral shaft and line drawn along axis of femoral neck passing through center of head of femur. The NSA ranges from 135 to 140 degrees at birth. The femoral neck-shaft angle decreases progressively to reach a value of about 125 degrees at puberty. Once growth is

complete no further changes are noted in the neck-shaft angle. If the NSA is greater than 135° this is referred to as coxa valga and the angle decreases less than 120° then it's referred to as coxa vara. (5)

2.1.3 The hip joint

The hip joint is located in between the head of femur and the acetabulum of the hip bone. The hip joint is a ball and socket synovial joint and it's very stable joint. There are several movements that occur at this joint, there is abduction, adduction, flexion, extension, medial rotation and lateral rotation. Flexion, extension, abduction and adduction can be combined to produce circumduction of the hip. (6)

The acetabulum has two parts, an articular and a non articular part. The acetabular fossa is a non articular part of the acetabulum and it is the point of attachment of the teres ligament. Surrounding the acetabular fossa is the lunate surface and it's the articular part of the acetabulum. The acetabular notch is located in between the lunate surface and it's inferior on the acetabulum. (1,2,4)

Surrounding the margins of the acetabulum is a fibro cartilaginous collar that is called the acetabular labrum, this deepens the acetabulum so it stabilizes the joint further. As the acetabular labrum crosses the acetabular notch it forms a ligament called the transverse acetabular ligament. (1)

The joint capsule of the hip joint attaches to the margins of the acetabulum and then attaches to the transverse ligament. In addition it attaches on the line in between the greater and lesser trochanter i.e. the intertrochanteric line and also proximally from the intertrochanteric crest. The main blood supply that comes to the head of femur comes from the vessels that travel underneath the capsule along the neck of femur. There is also a direct blood supply that comes into the head of femur by the ligament of the head of femur. (2,4)

Three main ligaments reinforce the hip joint capsule and they are the iliofemoral ligament, the pubofemoral ligament and the ischiofemoral ligament. The iliofemoral ligament is a triangular shaped ligament that attaches from in between the anterior inferior

iliac spine and the margin of the acetabulum and attaches into the intertochanteric line. The pubofemoral ligament attaches from the iliopubic eminence and attaches into the femur. The ischiofemoral ligament is attached from ischium to the greater trochanter of femur. (2)

2.1.4 Muscle anatomy

Table 1 Medial thigh muscles (2,7)

Muscle	Origin	Insertion	Innervation	Function
Adductor brevis	Inferior pubic ramus.	Linea aspera.	Obturator nerve.	Adducts thigh at hip, weak hip flexor.
Adductor longus	Inferior pubic ramus.	Linea aspera.	Obturator nerve.	Adducts thigh at hip.
Adductor magnus	Inferior pubic ramus.	Linea aspera.	Obturator nerve.	Adducts thigh at hip.
Gracilis	Lateral to pubic symphysis in line with inferior ramus of pubic bone.	Medial condyle of tibia.	Obturator nerve.	Adducts thigh, flexes and medial Rotates leg..
Obturator externus	Outer surface of obturator membrane, obturator foramen.	Trochanteric fossa.	Obturator nerve.	Laterally rotates thigh, stabilizes head of femur in acetabulum.
Pectineus	Pectineal line (pubic ligaments).	Between lesser trochanter and linea aspera.	Obturator nerve.	Adducts and flexes thigh at hip.

Table 2 Gluteal region muscles (2,7)

Muscle	Origin	Insertion	Innervation	Function
Gluteus maximus	Thoracolumbar fascia, sacrum, coccyx, sacrotuberous ligament, ilium.	Cranial part: gluteal tuberosity of femur. Caudal part: iliotibial tract.	Inferior gluteal nerve.	Extends flexed thigh, Assists in lateral Rotation, and Abducts thigh.
Gluteus medius	Outer surface of ilium between middle and posterior gluteal lines.	Greater trochanter.	Superior gluteal nerve.	Abducts and medially rotates thigh at hips.
Gluteus minimus	Outer surface of ilium between superior and inferior gluteal lines.	Greater trochanter.	Superior gluteal nerve.	Abducts and medially rotates thigh at hips.
Inferior gemellus	Ischial tuberosity.	Trochanteric fossa.	Sacral plexus.	Laterally rotates extended thigh.
Obturator internus	Obturator foramen.	Trochanteric fossa.	Sacral plexus.	Laterally rotates extended thigh.
Piriformis	Anterior surface of sacrum along borders of second to fourth sacral foramina.	Upper border of greater trochanter.	Sacral plexus.	Laterally rotates extended thigh.
Quadratus femoris	Ischial tuberosity.	Intertrochanteric crest.	Sacral plexus.	Laterally rotates. extended thigh
Superior gemellus	Ischial spine.	Trochanteric fossa.	Sacral plexus.	Laterally rotates extended thigh
Tensor fasciae latae	Outer surface of anterosuperior iliac spine.	Iliotibial tract.	Superior gluteal nerve.	Abducts, medially rotates, and flexes thigh at hip.

Table 3 Anterior thigh muscles (2,7)

Muscle	Origin	Insertion	Innervation	Function
Iliacus	Iliac fossa.	Lesser trochanter.	Femoral nerve.	Flexes thigh at hips and stabilizes hip joint.
Psoas major	Transverse processes of lumbar vertebrae, sides of bodies of T12–L5 vertebrae.	Lesser trochanter.	Femoral nerve.	Acting superiorly with iliacus, flexes hip.
Rectus femoris	Anterior inferior iliac spine and ilium superior.	Base of patella and to tibial tuberosity via patellar ligament.	Femoral nerve.	Extends leg at knee joint and flexes thigh at hip joint
Sartorius	Anterior inferior iliac spine and ilium superior.	Superior part of medial surface of tibia.	Femoral nerve.	Abducts, laterally rotates, and flexes thigh.
Vastus intermedius	Anterior and lateral surfaces of body of femur.	Base of patella and to tibial tuberosity via patellar ligament.	Femoral nerve.	Extends leg at knee joint.
Vastus lateralis	Greater trochanter, lateral lip of linea aspera of femur.	Base of patella and to tibial tuberosity via patellar ligament.	Femoral nerve.	Extends leg at knee joint.
Inferior gamellus	Intertrochanteric line, medial lip of linea aspera of femur.	Base of patella and to tibial tuberosity via patellar ligament.	Femoral nerve.	Extends leg at knee joint.

Table 4 Posterior thigh muscles (2,7)

Muscle	Origin	Insertion	Innervation	Function
Biceps femoris	Long head: ischial tuberosity Short head: Linea aspera and lateral supracondylar line.	Lateral side of head of fibula.	Sciatic nerve.	Flexes and laterally rotates leg, extends thigh at hip.
Semimembranosus	Ischial tuberosity.	Posterior part of medial condyle of tibia.	Sciatic nerve.	Flexes leg, extends thigh.
Semitendinosus	Ischial tuberosity.	Superior part of medial condyle of tibia.	Sciatic nerve.	Flexes leg, extends thigh.

2.2 Biomechanics

The hip joint is a proximal ball and socket joint that support the weight of the whole body going to the lower extremity and locomotion. The round head of femur articulates with the deep acetabulum that gives the hip joint its stability yet decreasing its mobility compared to other ball and socket joints such as the shoulder joint. (8)

While standing half of the body weight passes through each of the hip joint but in the swing phase of gait the weight that is acting upon one hip joint is around four of the normal weight. The forces that are acting across the hip joint are a combination of body weight W_t , ground reaction force R and abductor muscle force F_m . (9)

When a person stands on one limb the opposite side of the pelvis is going to drop down but this doesn't happen under normal circumstances because the abductors on the side on which a person is standing are being activated and pull the pelvis to keep the pelvis stable. (9)

In the case of coxa valga, it makes the lever arm in the hip joint is reduced. As a result the force in which the abductor muscles have to contract in order to keep the stable is increasing significantly. (10)

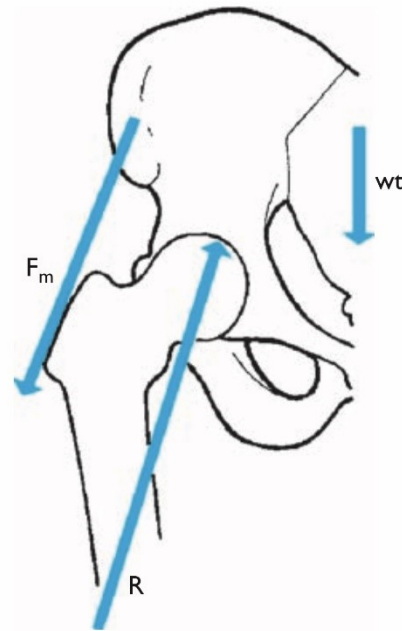


Photo 1 different forces acting on the hip joint (9)

2.3 Kinesiology

2.3.1 Flexion

Flexion of the hip varies in both active and passive motion and also whether if the knee joint is bent or not. If the knee is extended flexion in the hip arrives until 90° while if knee is flexed active flexion of the hip can arrive till 120° . The reason that the range of motion decreases when the knees are extended is due to the Hamstring muscles being stretched. Passive hip flexion can arrive to 140° and more. (8) The iliopsoas is the joint name given to the iliacus and psoas major muscles as they share the same common insertion. Two joint muscles are muscles such as the rectus femoris that flexes the hip and extends the knee. Two joint muscles function more effectively at one joint when the position of the other joint stretches the muscle slightly. (9)

2.3.2 Extension

The main extensors of the hip joint is the gluteus maximus and the hamstring muscles. (9) The extension range of motion in the hip joint isn't a lot and is limited by the iliofemoral ligament. Active extension in the hip is about 20°, if the knees are flexed the hip extension decreases slightly below 20° due to the hamstrings losing of their efficiency by bending the knee. Passive hip extension is also 20° but it can increase to 30° of extension if the lower limb is bent forcibly. Anterior tilting of the pelvis also increase extension of the hip joint. (8)

2.3.3 Abduction

The gluteus medius is the main abductor of the hip and it also plays an important role in stabilizing the pelvis during the swing phase of gait. The abductors contract isometrically and eccentrically on the limb that's bearing weight during the swing phase and prevent the second limb that's not bearing any weight from dropping. (9) Theoretical it's possible to abduct one hip only but in practice abduction in one hip joint is automatically followed with the abduction of a similar degree in the second hip. Also abduction is accompanied with an anterior tilt of the pelvis which becomes obvious after 30° of abduction in the hip. Maximum abduction that can be achieved in the hip is 45°. (8)

2.3.4 Adduction

Movement of adduction is performed by the hip adductor muscles that are include the adductor longus, adductor brevis, adductor magnus and gracilis. In addition to adduction the gracilis assist in flexion of the knee. (9) Pure adduction doesn't occur in the hip joint due to the position of the lower limb. Adduction happens in the hip joint relatively in the form of one limb moving medially from a position of abduction. Another situation is when one limb is moved into abduction allowing the second limb to go into adduction. Adduction at the hip joint can also happen with the combination of either extension or flexion. In all the situations adduction occurs at the hip joint the range of motion of adduction of the hip is 30°. (8)

2.3.5 Medial and lateral rotation

Medial rotation of the hip occurs with a total range of motion of 30° to 40° while lateral rotation occurs with a total range of motion of 60°. (8) During the gait cycle, lateral and medial rotation of the femur occur in coordination with pelvic rotation. (9) The importance of hip external rotation lays on its usage, for example when the right femur is fixed in its position, activation of the external rotators would rotate the pelvis and the trunk to the left side. This is important while performing pelvic and trunk rotations exercises. (10)

2.4 Hip fractures

The pelvis and femur are large and strong bones but due the fact that the hip is subjected to high repetitive load that can range from four to seven times the body weight during locomotion it's subjected to fractures. Fractures of the femoral neck is a seriously debilitating injury that occurs frequently among elderly individuals most frequently with osteoporosis and falling. (9) Fracture of the hip can also be displaced or non displaced fractures with displaced fractures meaning that the bone breaks into two or more piece and the two ends move apart which results in the bone being no longer aligned straight. (12,16)

Since a hip fracture is defined or referred to as a fracture of the upper end of the thigh bone i.e. femur, this generally means that there are three types of hip fractures that can occur according to locality of the place where the fracture occurred. (13)

First group is the femoral neck fracture that occurs below the head of femur. (13) This type of fracture is located inside the hip joint capsule and because fracturing the neck of femur can result in cutting the blood supply to the head of femur this results in avascular necrosis of the femoral head. (14)

The second group of hip fractures are fractures that occur around the intertrochanteric crest, the bony structure that connects the greater trochanter with the lesser trochanter and this area is an attachment point for major muscles of the hip. (13)

The third group of hip fractures is sub trochanteric fractures that start at or below the lesser trochanter and involve the femoral shaft itself. (13)

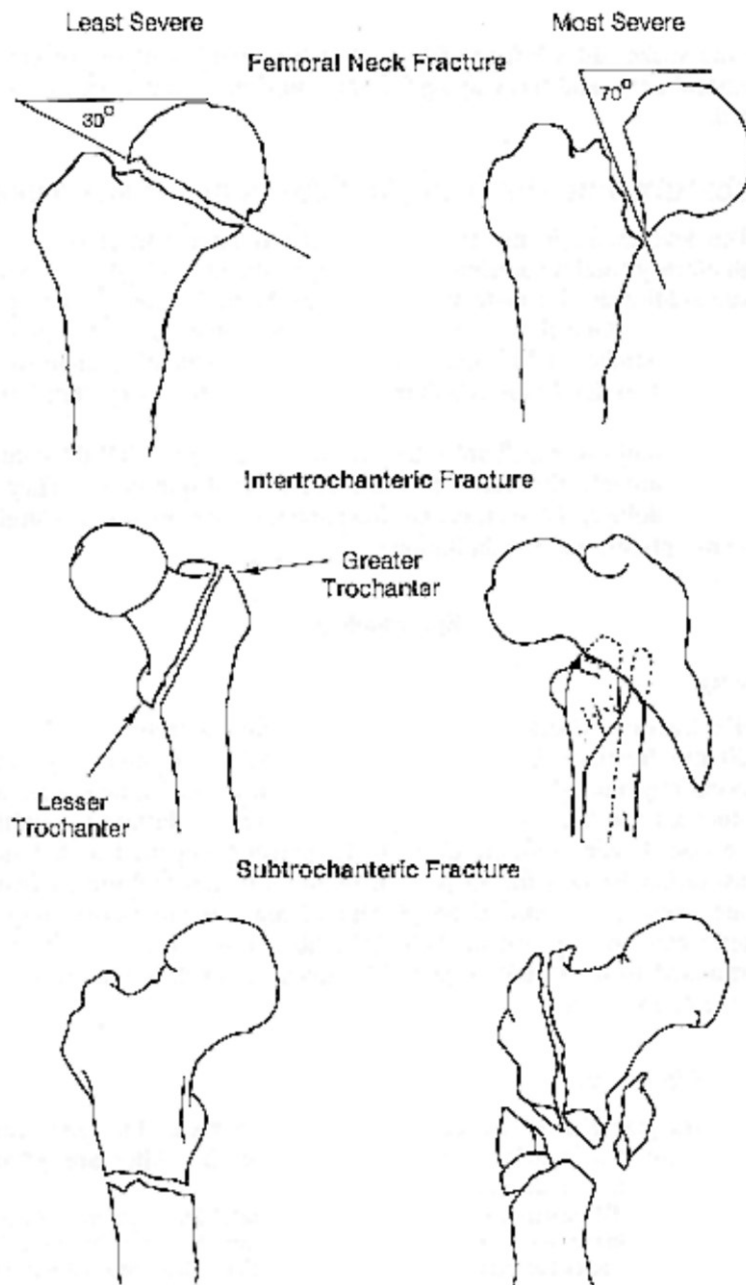


Photo 2 Examples of main types of hip fracture (13)

2.5 Etiology

The two main factors for hip fractures are degenerative bone disease osteoporosis and falling. Falling is a common event for elderly people. Around 30% to 50% of the elderly experience at least one fall per year, increasing the chances of injury in elderly people. (13) Woman experience 80% of all hip fractures and the average age at which elderly fracture their hips is about 80 years of age. (20)

In a study comparing the annual total numbers of hip fractures by sex in Canada it clearly shows the huge difference in hip fracture injuries in woman vs. men. (30)

	Women	Men	Total
2000	20,853 (72.1)	8,060 (27.9)	28,913
2001	20,951 (72.3)	8,021 (27.7)	28,972
2002	20,952 (71.9)	8,206 (28.1)	29,158
2003	21,507 (72.1)	8,339 (27.9)	29,846
2004	21,515 (71.4)	8,608 (28.6)	30,123
2005	21,316 (71.3)	8,567 (28.7)	29,883

Photo 3 annual total numbers of hip fractures by sex in Canada, 2000 – 2005. (30)

2.6 Classification

The Garden classification is a widely used classification system for femoral neck fractures. It classifies fractures according to the amount or degree of displacement and it relates the amount of displacement to the risk of vascular disruption. It also classifies fractures into two groups, first Non displaced type I and type II and second displaced type III and type IV.

- Type I, the fracture is an incomplete and impacted in valgus.
- Type II, the fracture is complete and non displaced.

- Type III, is a complete fracture and its partially displaced.
- Type IV, the fracture is completely displaced with no continuity between the proximal and distal fragments. (13,16)

Pauwel's classification is another system used to classify hip fractures based on biomechanics, according to the orientation and direction of the fracture line across the femoral neck. It relates to the biomechanical stability. The more vertical the fracture, the more instability increases.

- Type I has an obliquity ranging from 0° to 30° .
- Type II has an obliquity ranging from 30° to 50° .
- Type III has an obliquity ranging from 50° to 70° or more. (17)

2.7 Clinical picture

Patients that are suspected of a hip fracture are usually complaining of pain in the groin that increases if the patient tries to put weight on his/her affected leg. The patients are usually unable to move their hips into flexion, extension and rotations. Appearance wise the injured leg would appear to be shorter in comparison with the uninjured leg and also the injured leg would be in an externally rotated position. (18,19,20)

2.8 Diagnostic imaging

X-rays are usually used to diagnose hip fractures but x-rays aren't always able to show hidden partial fractures. That's why MRI imaging is further required to investigate if the hip is fractured or not. (20,21)

2.9 Surgical treatment

The surgical method that is gets used to treat hip fractures usually depends on the type of fracture and the patients need. Nondisplaced femoral neck fractures are usually treated with dynamic screw replacements, while displaced fractures are treated with hip replacement.

Patients that tend not to be very active and with a femoral neck fractures are treated with hemiarthroplasty, while patients that are highly active during the day have better outcomes with total hip replacement.

Intertrochanteric fractures that are stable usually are treated with sliding hip screw, while the unstable intertrochanteric fractures are treated with intramedullary hip screws.

Subtrochanteric fractures may have typical or atypical patterns and are more difficult to reduce surgically therefore they are treated with an intramedullary hip screw. (13,22)

In the treatment of fractures with older patients, arthroplasty is a more common method of treatment. In younger patients internal fixation is more probable to be introduced. The reason why arthroplasty is older patient have higher rates of failure if an internal fixation was to be used. In addition elderly patients that undergo arthroplastic surgeries require less hospitalization and can have a quicker recovery. (15)

2.10 Conservative treatment

Conservative treatment methods are considered for some patients that can continue to suffer from postoperative symptoms, remain severely impaired functionally and don't have the ability to return to prior functional level. Such patients are usually:

- Very old patients.
- Patients living in nursing homes.
- Moderate or severely mentally disabled patients.
- Severely physical disabled patients.
- Patient with severe comorbid conditions. (13)

Conservative treatments that don't utilize surgical procedures include traction and bed mobility. Conservative treatment is also preferred in fractures that are without any dislocation. (21, 23) The reason why operative intervention is more convenient rather than

conservative treatments is the rehabilitation time period that's very long in conservative treatments. (23)

2.11 Physiotherapeutic methods

The number of physiotherapeutic techniques that could be chosen in the form of treatment to help the patient heal and recover to activities of daily living are numerous and all depend on the patient's condition and specific needs for the patient to be rehabilitated optimally. Relaxation techniques could be utilized to relax hypertonic muscles. Strengthening of weak muscles is also very beneficial in restoring muscle balance and also maintain optimal activity without it deteriorating due to surgery. Open and closed chain exercises and resistive exercise are also recommended. Manipulative methods and early mobilization in neighboring joints or segments seems to be beneficial in the prevention of compensatory mechanism and secondary changes.

Training stability is another aspect that could be used to improve the patient's condition and at the same time prevent future injuries. Training stability can be done in so many for example by improving stability in gait, improving global stability and strength of muscles round the hip joint or even improving global stability by strengthening the deep stability system.

Also as arthroplasty is quite a big surgery and due to the fracture DVT should also be taken into consideration to prevent any complication. Restoring soft tissue mobility and sensitivity is also an important part of the healing process that is also very important.

Modalities that are indicated for the scar include phototherapy such as laser and also hydrotherapy. Ultrasound or electrotherapy and hydrotherapy are also indicated to relax muscles. (21,24,25,26,27)

3. Case Study

3.1 Methodology

The clinical work for this bachelor thesis took place in the orthopedic surgery department of the Central Military Hospital in Prague, Czech Republic, from the 14th of January 2019 till the 25th of January 2019. All clinical work during this time period was performed under the supervision of Bc. Martin Lassner.

The case study has one female participant aged 85 years and diagnosed with an unspecified fracture of the proximal femur S72.0. The patient underwent surgery in the form of intervention for the fracture. The total amount of session were 6.

The patient was informed of my position as a student and her participation in the therapy for the completion of my bachelor's thesis, in which her consent was given. Treatment by approval of the ethics committee of the faculty of physical education and sports at Charles University in Prague.

3.2 Patient anamnesis

- Examined person: JB.
- Gender of the examined person: Female.
- Year of birth: 1933, 85 years old.
- Main diagnosis and other diagnoses – ICD 10 codes:
 - Subcapital fracture of the left femur – S72.0.
 - Atrioventricular block type 2 – I44.1.
 - Presence of a cardiac pacemaker – Z95.0.
 - Atrial hypertension – I10.

3.2.1 The present status

Objective

- Assistive devices: High walker, reading glasses.
- Height: 165 CM.
- Weight: 65 Kg.
- Body mass index: 23.9 Kg/m².
- Somatotype: Ectomorph.
- Blood pressure: 135/85 mmHg.
- Heart rate: 73 beats per minute.
- Respiratory rate: 12 breaths per minute.

Subjective:

- Chief complaint: Pain in the left hip.

- History of the present problem:

Approximately 18 months, during the month of July 2017 while the patient was in her kitchen at home she accidentally slipped and fell to the ground. As a result the patient ended with a distal fracture of the left femoral bone. Following her injury the patient required surgical intervention in the form of inserting an intramedullary nail into the femoral bone.

In January 2019 the patient slipped and fell again on her left thigh resulting in a proximal fracture of the femoral bone. Surgery was again required to remove the intramedullary nail that was introduced in July of the past year. A partial hip arthroplasty was indicated to replace the femoral neck.

- Personal anamnesis and motor development:

Normal development during childhood without any diseases. The patient currently suffers of atrioventricular block type II and atrial hypertension since 1993.

- Past medical and surgical anamnesis:

- Fibroadenoma surgery of the right breast in 1987.
- Wrist surgery with metal fixation in 1995 as a result of fracture of the right wrist.
- In 1998 the patient also suffered from varicose veins in both legs.
- In 2005 a pacemaker was implanted and a planned replacement of the pacemaker was performed on the 2nd of January 2019.
- In 2017 the patient had a distal fracture of the left femoral bone and intramedullary nail was introduced surgically.

- Medication and pharmacological anamnesis:

- Warfarin 3 MG – 1 tablet daily.
- Twynsta 80/5 MG – 1 tablet daily.
- Metamizol stada 500 MG – 1 tablet every 6 hours.

- Allergic anamnesis: None.

- Gynecological anamnesis: Menopause at the age of 42. The patient gave birth twice and had one abortion.

- Abuses: Doesn't smoke or drink alcohol. Drinks 1-2 cups of coffee daily.

- Diet: Normal diet with low sodium intake and no alcohol consumption.

- Functional anamnesis:

- The patient is unable to bend her hip over 90 degrees of hip flexion, perform hip adduction nor place her lower extremities in external rotation due to the partial hip replacement surgery.
- The patient has the ability to perform all activities of daily living with the assistance of crutches. A restriction is present during normal performances due to crutches and also pain in the left hip after the surgery.
- Walking and standing is possible with the assistance crutches.
- The patient normally sleeps for an average of 6-7 hours a day on supine and side lying positions. In regards with the partial hip replacement surgery the patient currently places a pillow in between her thighs to avoid hip adduction while sleeping.
- The patient can't sit normally as the hip flexion must not exceed 90 degrees so the patient has to adjust her sitting position.

- Family anamnesis:

At the age of 79 the patient's mother suffered from liver cirrhosis. Her father had prostate cancer at the age of 84. The patient's brother and granddaughter both suffer from cardiac arrhythmia.

- Social anamnesis:

The patient lives together with her daughter, son in law and grandchildren in a 2 floor house. Her room is located on the ground floor with no steps used to enter the house. The patient doesn't have any anxiety nor depression.

- Occupational and vocational anamnesis: Retired scientific researcher at the University of Economics.

- Past and current sports, regular physical activities and hobbies:

- Past – swimming and mushroom picking.
- Current – reading books and visiting museums.

3.2.2 Prior rehabilitation

None.

3.2.3 Statement from the patient's medical documentation

Preoperative X-ray imaging show the intramedullary nail with its three locking pins and the subcapital fracture of the left femur.

The postoperative X-ray imaging shows the replacement of the femoral neck with an artificial prosthesis that goes into the marrow of the femur and simultaneously the metal head of the prosthesis that's shaped like a ball fitting into acetabulum without any structural changes to the acetabulum.

X-ray images are attached in the supplements section.

3.2.4 Rehabilitation indications

- Pain relief.
- Early verticalization of the patient from her bed.
- Prevention of musculoskeletal changes and postoperative complications.
- Maintaining joint movement and mobility within the physiological ranges.
- Wound and scar care.
- Educating the patient on her current situation after the surgery as hip flexion over 90 degrees, hip adduction and hip external rotation are contraindicated from the surgeon.

- Training with the patient on how to use assistive devices appropriately.

3.2.5 Differential balance

At the moment the patient appears to be very unstable while she is walking and requires the assistance of a walker to keep her balance stabilized. But most of the current instability is temporarily due to the patient being only a few days after a partial hip replacement surgery.

My hypothesis is that she does indeed have slight instability because this is the second time the patient falls down to the ground and fractures her femur. The reason for this instability can be for first, the position of the right foot being in pronation and also the subtalar joint of the foot getting blocked. The pronation causes flat foot to occur on the right foot and therefore the patient can't have an optimal movement of the foot. Also the blockage of the subtalar and talocrural joints decrease proprioception in the right foot.

Another factor that caused influence the stability was that the patient isn't using and utilizing her deep stabilization system properly and she is relying rather on other muscles for compensation.

3.3 Initial kinesiological examination

3.3.1 Static postural examination (the patient was supported with a high walker during this assessment)

Posterior view

Table 5 Initial posterior postural view

The base of support:	Narrow base of support. Both feet are enclosed within a 30° angle.
Shape and contour of the heels:	Normal shape and contour of both heels.
Shape and position of the ankle joints:	Pronation of the right ankle. Partial plantarflexion of the left ankle.
Shape and thickness of the Achilles tendons:	Normal shape of the Achilles tendon of the right leg. On the left leg the Achilles tendon appears to be shorter.
Contour of the calf muscles:	The left calf appears to be wider than right calf.
Shape and position of the knee joints:	The left knee is in a semi flexed and externally rotated position. The right knee is in internal rotation.
Popliteal line:	The right popliteal line is higher than the left popliteal line.
Contour of the thigh muscles:	Normal contour and symmetry in both legs.
Subgluteal line:	The right subgluteal line is higher than the left subgluteal line.
Gluteal muscles:	Slight atrophy of the gluteal muscles on both sides.
Symmetry of the thoracobrachial triangles:	The right thoracobrachial triangle is bigger than the left triangle.
Position of the pelvis:	Left lateral pelvic tilt.
Paravertebral muscles:	No muscular abnormality.
Curvature of the spine in the frontal plane:	Slight lateral curvature of the spine to the left side with the top of the curve being at Th10-Th11.
Position of the scapula:	Both scapulas are slightly abducted.
Position of the shoulder girdle:	The left shoulder is elevated plus both shoulders are protracted.
Position of the upper limb:	Optimal without any rotations.
Position and contour of the nuchal muscles:	The left trapezius muscle is higher and it's also more prominent.
Position of the head:	Lateral tilt to the right.

Lateral view

Table 6 Initial lateral postural view

Weight distribution	The weight is distributed medially on both sides .
Shape and position of the ankle joints	The left ankle is partially in plantar flexion while the right one is pronated.
Shape and contour of the shin	Normal shape and symmetry in both sides.
Position of the knee joints	The left knee is semi flexed and externally rotated while the right knee is internally rotated.
Contour of the thigh muscles	The muscles on the right thigh appear to be more prominent than the left side especially on the lateral side.
Position of the pelvis	The pelvis is tilted anteriorly.
Position and curvature of the spine	Increased lumbar lordosis.
Shape of the abdominal muscles	The stomach is slightly bulging out.
Position of the shoulder girdles	Both shoulders are protracted.
Position of the head	The head is slightly protracted.

Anterior view:

Table 7 Initial anterior postural view

The base of support:	Narrow base of support. Both feet are enclosed within a 30° angle.
The position of the feet:	The right foot is pronated. The left foot is in light partially plantar flexion.
The position and shape of the toes:	The patient's toes on the left foot are semi extended. Halux valgus was present on both feet.
Weight distribution:	The weight is distributed medially.
Shape and position of the knee joints:	The left knee is in a semi flexed and externally rotated position. The right knee is in internal rotation.
Configuration of the tibialis anterior muscle:	Symmetrical on both sides.
Contour of the anterior compartment muscles of the lower leg:	Symmetrical on both sides
Position of the pelvis:	Anterior pelvic tilt and left lateral pelvic tilt.
Muscle tone symmetry of the abdominal muscles:	Decreased tone of the abdominal muscles with the stomach bulging out a little.
Position of the umbilicus:	The umbilicus is slightly pulled to the left side.
Symmetry of the thoracobrachial triangles:	The right thoracobrachial triangle is bigger than the left triangle.
Position and symmetry of the chest:	The chest is symmetrical without any deformities.
Position of the sternum:	Optimal position without any rotations.
Position of the collarbones and superclavicular holes:	Both the collarbones and the superclavicular holes are in optimal position.
Position of the shoulder girdle:	The left shoulder is elevated plus both shoulders are protracted.
Position of the upper limbs:	Optimal without any rotations.
Position of the head:	Lateral tilt to the right.

3.3.2 Palpation of pelvis

- Height and symmetry of cristae iliacae: The right crista iliaca is higher.
- Height and symmetry of SIPSs: The right SIPSs is higher.
- Height and symmetry of SIASs: The right SIASs is higher.
- Position of the pelvis: The pelvis is in anteversion position with a lateral tilt to the left side.

3.3.3 Assessment of stereotype of breathing

Table 8 Initial breathing assesment

Position	Standing	Sitting	Laying
Position of the trunk	The chest is in an inspiratory position with the sternum going crainally only when the patient is laying down.		
Shape of the trunk	Normal shape in all positions.		
Frequency	12	12	11
Intensity	The breathing rhythm is more intense in both standing and sitting.		
Mobility of trunk, abdomen, shoulders and head	Decreased mobility of the trunk, shoulders and head during standing and sitting while their mobility increases in laying position.		
Activity of accessory muscles	No shown reaction of activity of the accessory muscles.		
Breathing type	Abdominal	Abdominal	Both abdominal and lower trunk.

3.3.4 Specific Testing of posture

- Véle test: Grade 2.

3.3.5 Anthropometric measurements (Measured using a “Linen Measuring Tape”)

Table 9 Initial anthropometric measurements

Height measurements	In standing	In sitting	Arm span
	165 cm	86 cm	158 cm
The anatomical length	Left side 81 cm	Right side 79 cm	
The functional length	From SIAS to malleolus medialis Left side 87 cm	Right side 85.5 cm	
	From umbilicus to malleolus medialis Left side 92.5 cm	Right side 91 cm	
The length of the thigh	Left side 41 cm	Right side 40 cm	
The length of the middle leg	Left side 35 cm	Right side 35 cm	
The length of the foot	Left side 23 cm	Right side 23 cm	
The circumference of the thigh	15 cm above the knee cap Left side 47 cm	Right side 41 cm	
	10 cm above the knee cap Left side 45 cm	Right side 40 cm	
The circumference of the knee joint	Left side 40 cm	Right side 37 cm	
The circumference of the calf	Left side 34 cm	Right side 35 cm	
The circumference of the ankle	Left side 26 cm	Right side 26 cm	
The circumference of the foot	Left side 22 cm	Right side 22 cm	
The circumference of the thorax	In the middle of the sternum: 72 cm maximal exhalation, 80 cm normal position and 83 cm maximal inhalation. In the height of process xiphoid: 67 cm maximal exhalation, 70 cm normal position and 75 cm maximal inhalation.		
The circumference of the waist	67 cm		
The circumference of the hips	99 cm		
The width dimensions	Biacromial: 42 cm Bicristal: 45 cm Bispinal: 29 cm Bitrochanterical: 44 cm		

3.3.6 Gait analysis (the patient was supported with a high walker):

Table 10 Initial gait analysis

Width of the base of support	Narrow base of support.
Walking rhythm	Unsymmetrical with the patient moving her right leg faster while dragging her left foot on the ground.
Walking speed	The speed in both extremities is slow, slower on the left side.
Stride length	The stride length of the left foot is shorter.
Movement of the foot	
➤ Heel strike	Optimal on both sides.
➤ Flat foot	Present on the right foot.
➤ Loading response	Optimal response is absent on both sides.
➤ Heel off	Optimal only on the right side while being absent on the left side.
➤ Toe off	Optimal only on the right side while being absent on the left side.
Movement and position of the knee and hip	On the the left hip the patient doesn't extend her hip while walking and rather flexion is more dominant. The left knee is also in a semi flexed position during gait.
Position and movement of the pelvis	The pelvis is in a slightly anterior tilt position and dropping as well during gait to the left side.
Movement of center of gravity	The patient is unstable and needs the support of a high walker.
Position and movements of the trunk	The trunk is slightly bent forward.
Position of the spine	No rotations of the spine were found.
Activity of the back muscles	Normal activity was shown.
Activity of the abdominal muscles:	Minimal activity was shown.
Position of the shoulders	Shoulders were slightly protracted.
Position and movements of the head	The head was slightly protracted.
Movements of the upper extremity	Wasn't clearly shown due to the support of the high walker.
Stability of walking	The patient walks steadily only with the support of a high walker otherwise the patient is unstable.

Typology of Gait according to Janda: Distal gait pattern.

3.3.7 Measurement of range of motion (SFTR format, goniometry according to Janda)

Table 11 Initial measurement of range of motion

	AROM		PROM	
	Left	Right	Left	Right
Hip joint	S 0-0-25	S 10-0-100	S 5-0-30	S 10-0-110
	F 15-0-CI	F 30-0-15	F 25-0-CI	F 35-0-20
	R CI-0-10	R 20-0-35	R CI-0-20	R 30-0-45
Knee joint	S 0-0-100	S 0-0-110	S 0-0-115	S 0-0-115
Ankle joint	S 20-0-50	S 20-0-50	S 40-0-50	S 30-0-50
	R 15-0-30	R 25-0-20	R 20-0-40	R 25-0-25

3.3.8 Joint end feel and joint play examination (Lewit approach)

Table 12 Initial joint play examination

Joint	Left		Right	
	End Feel	Joint Play	End Feel	Joint Play
Tibiofemoral	Firm.	Restricted into the medial direction.	Firm.	Free.
Patellofemoral	Firm.	Restricted into the caudal direction.	Firm.	Free.
Head of fibula	Firm.	Restricted into both the dorsal and ventral directions.	Soft.	Free.
Talocrural	Firm.	Free.	Firm.	Slight restriction into the direction of Plantar flexion.
Subtalar	Firm.	Free.	Firm.	Restricted into the direction of inversion.
Lisfranc & Chopart	Firm.	Free.	Firm.	Free.
MTP	Firm.	Free.	Firm.	Free.

3.3.9 Examination of shorted muscles (according to Janda)

Table 13 Muscle length assessment

Muscle	Left	Right
Test for length of triceps surae muscle	Grade 2	Grade 1
Test for length of hip adductor muscles	Grade 1	Grade 1
Test for length of hamstring muscles	Grade 2	Grade 1

Muscle length examination for the hip flexors, hip abductors and piriformis muscles weren't possible to be performed as the testing positions for these muscles required the patient to have her hip joint in a position that is contraindicated by the surgeon.

3.3.10 Manual muscle strength testing (according to Kendall)

Table 14 Initial manual muscle strength testing

Muscle	Right	Left
Gluteus maximus	6	3
Iliopsoas (with emphasis on psoas major)	5	2
Quadriceps femoris	7	5
Hip flexors as group	6	3
Hip adductors	6	3
Gluteus minimus	6	3
Gluteus medius	6	3
External rotators	7	5
Medial hamstring	8	5
Lateral hamstring	8	6
Triceps surae	8	8
Soleus	8	8
Gastrocnemus, plantaris, Peroneus longus and peroneus brevis	8	8
Tibialis posterior	8	9
Tibialis anterior	8	6

Muscle strength testing of the quadriceps femoris, hip flexors as group, hip adductors, external rotators of the hip and lateral hamstrings were not tested according to the standard methodology of Kendall as the testing positions for these muscles required the

patient to have her hip joint in a position that is contraindicated by the surgeon. To test these muscles I modified the positions to meet the patient's condition, therefore possible faulty errors should be taken into consideration.

According to Kendall to test the quadriceps femoris the patient is supposed to be sitting on the table with her knees over the side of the table. Instead of sitting, the patient was laying in supine position with her knee at the edge of the table and leg being outside the table allowing the knee joint to be extended and flexed without any flexion of the hip.

Testing the hip flexors as a group according to Kendall, the patient has to be sitting on the table with her knees over the side of the table, similarly as for testing the quadriceps femoris. Here again the patient was instead in supine position with her knee at the edge of the table and the patient was asked to flex her hip and hold from that position. The patient was also placed into side lying to further asset the left hip flexors in antigravity position.

Testing the hip adductors according to Kendall the patient requires the patient to be in side lying on the tested. For the side leg that's not tested the patient places it in abduction with the help of the therapist and the tested goes too adduction and the therapist resists. Instead of this position, the patient was placed in supine position and the operated leg of the patient.

Testing the external rotators of the hip according to Kendall, the patient has to be sitting on the table with her knees over the side of the table. Here again the patient was instead in supine position with her knee at the edge of the table and the patient was asked to try and perform external rotation while holding the test position.

To test the lateral hamstrings according to Kendall, on prone position, the patient should have her knee flexed for about 60° and the thigh being in slight external rotation. The position that was used didn't involve the patient to place her hip in external rotation.

3.3.11 Palpations:

Table 15 Initial palpations

Muscle	Muscle tone		Pain – MO, MI, MB	
	Left	Right	Left	Right
Rectus abdominis	Hypotone	Hypotone	No pain	No pain
Iliopsoas	Hypertone	Hypertone	Muscle belly	Muscle belly
Gluteal maximus	Hypotone	Hypotone	No pain	No pain
Piriformis	Normal tone	Normal tone	No pain	No pain
Abductor muscles	Hypotone	Normal tone	Muscle belly	No pain
Adductor muscles	Hypertone	Hypertone	No pain	No pain
Hamstrings	Hypertone	Normal tone	Muscle insertion	No pain
Quadriceps muscles	Hypotone	Normal tone	No pain	No pain
Gastrocnemius	Hypertone	Normal tone	Muscle belly	No pain

3.3.12 Scar examination (observation only)

The patient at the moment of the examination has 2 scars on the left lower extremity.

The first scar is located on anterolateral aspect of the left thigh above the greater trochanter. The scar is circa 11 cm long.

The second scar is located on the lateral epicondyle of tibia on the lateral aspect of the thigh. The scar stretches for about 4 cm in length.

In both scars the stitches are still unremoved since both scars are 3 days old. There are no signs of inflammation or warmth near both scars. Slight swelling is present around the scar and the whole thigh. The skin around both scars feels soft upon palpation. The patient's sensation near the first scar is decreased.

3.3.13 Fasciae examination

Table 16 Initial fasciae examination

Fascia	Left	Right
Upper leg	No restrictions in both medial and lateral directions.	No restrictions in both medial and lateral directions.
Lower leg	Slight restriction in both the medial and lateral directions.	Slight restriction in the lateral direction.
Achilles tendon	No restrictions in both medial and lateral directions.	No restrictions in both medial and lateral directions.

3.3.14 Deep system stabilizers examination

The Australian School Approach:

- Multifidi palpation: The patient wasn't able to contract the multifidi muscles properly in the segments L1-L5 and on the left side of the spine from the thoracic spine till the cervical spine, palpation was painful for the patient especially around the spinal segments C7-T1.
- Transversus abdominis: Positive sign, the abdominal wall wasn't flattened.

Prof. Kolář Approach:

- Extension test: Positive sign, the patient was activating her paravertebral muscles significantly around the lumbar area. Support was on the umbilicus. There was an excessive activity of the hamstrings.
- Trunk diaphragm test: Positive sign, the diaphragm activity wasn't clearly visible during aspection and the patient couldn't activate the diaphragm against pressure. No other signs disturbances.

3.3.15 Neurological assessment:

History: The patient has no neurological history in neurology without any neurological diseases also in her family.

Mental status

Consciousness:

The patient is fully conscious and aware of her surrounding environment, place, time and current situation with no other signs of altered consciousness or coma. Scored 15 (maximum) according to the *Glasgow Coma Scale*.

Higher cerebral function:

The patient is able to communicate freely and recall from both her recent and remote memories with no problems. The patient can solve everyday problems corresponding to both her personal and professional lives with no emotional disturbances such as anxiety or depression.

Scalp and skull: No deformities, scars or tenderness were present.

Examination of the neck

Cervical column: Normal mobility during active and passive movements.

Carotid arteries: Symmetrical with no disturbances.

Examination of the upper limbs

Appearance: Normal physiological appearance without any deformities, asymmetries etc.

Palpation: Optimal muscle tonus.

Mobility:

Optimal mobility in joints of the upper extremity with the ability to perform all sorts of active and passive movements.

Power: Optimal power output.

Deep reflexes:

- **Biceps reflex (C5):** Normal
- **Radial reflex (C6):** Normal
- **Triceps reflex (C7):** Normal

- **Finger jerk (C8):** Normal

Cerebellar examination: The patient is able to touch her nose with her finger.

Elementary postural reflexes: Negative.

Examination of the abdomen

- **Epigastric (T7-8):** Positive
- **Mesogastric (T9-10):** Positive
- **Hypogastric (T11-12):** Positive

Examination of the lower limbs

Appearance:

Post-surgical edema is present on the left lower extremity. The swelling is mainly spreading on the anterior and lateral aspect of the thigh from around the hip joint till about the knee joint. Two surgical scars are also present.

Palpation:

Decreased tone of the rectus abdominis, gluteus maximus and quadriceps muscles. Increased tone of the iliopsoas, adductor muscles, hamstrings and the left gastrocnemius muscles.

Mobility:

Decreased mobility in joints of the hip joint and disturbed ability to perform some of the active and passive movements of the lower extremity.

Power: Decreased power output.

Deep reflexes

- **Patellar reflex (L2-4):** Normal
- **Achilles tendon reflex (L5-S2):** Normal
- **Medioplantar reflex (L5-S2):** Normal

Cerebellar examination:

The patient was able to complete the heel to chin test on the right and failed on the left side due to surgical restrictions.

Elementary postural reflexes: Negative

Examination of dermatomes of both lower extremities:

Table 17 Initial sensation of the lower extremity

Dermatome	Left	Right
Dermatome of L1 segment	Normal sensation	Normal sensation
Dermatome of L2 segment	Normal sensation	Normal sensation
Dermatome of L3 segment	Normal sensation	Normal sensation
Dermatome of L4 segment	Decreased tactile sensation especially around the hip joint.	Normal sensation
Dermatome of L5 segment	Decreased tactile sensation especially around the hip joint.	Normal sensation
Dermatome of S1 segment	Normal sensation	Normal sensation
Dermatome of S2 segment	Normal sensation	Normal sensation

3.3.16 Initial kinesiological examination conclusion

The patient showed from the initial examination some kinesiological changes in the lower extremity that can be compiled into two main groups of changes.

First of all, the patient while standing has her pelvis in anteriorly tilted position. The patient was unable to extend her hip joint during gait and the left lower extremity was semi flexed in both the hip and knee joints. The patient wasn't able to maintain her pelvis without dropping it to the left lateral side which indicated weakness of the gluteus medius. Upon palpation the gluteus maximus and the rectus abdominis muscles on both sides showed hypotone while the gluteus medius on the left side was hypotonic. Also the adductor muscles were found to be hypertonic along with the hamstrings on the left side. From the muscle strength examination the gluteus maximus muscles on both sides were weak but weakness was more on the left side. Also the abductor muscles on the left side were weak as well. The abdominal muscles showed minimal activity during gait. The hamstrings were both shortened with grade 2 according to Janda on the left side and grade

1 on the right side. All of these kinesiological findings collectively indicate that the patient has lower crossed syndrome as described by Janda.

The second group of changes was found more exclusively on the right leg. While standing, the patient had her right foot in pronation and in gait flat foot was present. The pronation of the right foot caused the patients right lower extremity to be more in internal rotation and also caused a blockage mainly in the subtalar joint play.

Other kinesiological changes that were found on the left leg was that the plantar flexors of the foot were hypertonic and short, especially the gastrocnemius muscle. This was influenced by the semi flexion of the left knee that results in the left heel to become slightly suspended from the ground and the due to the gravity force pulling the foot into plantar flexion this facilitates the plantar flexors of the ankle joint.

The patient uses an antalgic gait to walk and her center of gravity is quite unstable plus her left thigh is swollen without any signs of complications of the scar.

3.4 Physiotherapy plan

3.4.1 Short term plan

- Reducing swelling of the left thigh.
- Reducing pain around the hip joint.
- DVT prevention exercises.
- Increasing the ROM of the left hip into extension, flexion, abduction and internal rotation.
- Strengthening the abdominal muscles, deep system stabilizers and gluteus maximus on both sides.
- Diaphragmatic breathing exercises.
- Strengthening the gluteus medius and minimus on the left side.
- PIR for the hamstrings, hip adductors and gastrocnemius and iliopsoas muscles.

- Mobilization of the left tibiofemoral joint, patellofemoral joint and of the head of fibula.
- Mobilization of the right talocrural joint and subtalar joint.
- Release of the lower leg fascia.
- Mobilization from bed into sitting and standing.
- Educating the patient on how to use french crutches.
- Gait training with partial weight bearing.

3.4.2 Long term plan

- Eliminating pain.
- Improving the stability of the core and deep system stabilizers.
- Improving the walking pattern.
- Maintain cardiac condition.
- Restoring of normal ROM in the LE.
- Restoring optimal muscle power output of the LE.
- Treatment of the scar and restoration soft tissue mobility around the scar.
- Ability of the patient to return and perform ADL and hobbies.
- Educating the patient to perform self therapeutic techniques and exercise at home.

3.5 Therapy progress

Session 1

Date: 14th of January 2019.

Duration of therapy: 45 minutes.

Subjective: Today was the first time I've met with the patient and this session was the first rehabilitation session for the patient after the surgery. The patient is approximately 3 days after the surgery. On a scale of 1-10 the patient describes the pain as a level 5.

Objective: The initial kinesiological examination was performed today and the therapy session was drafted upon the findings in the initial examination.

Goal of today's therapy session:

- Reduction of swelling of the left thigh.
- Reducing pain around the left hip joint.
- DVT prevention.
- Improving diaphragmatic breathing.
- Increasing the PROM of the left hip into flexion, abduction and extension.
- Strengthening the left gluteus medius and minimus.
- Strengthening the core muscles.
- Relaxation of both hip adductors, left lateral hamstrings, left iliopsoas and right gastrocnemius.
- Release of the lower leg fasciae.
- Mobilization of the left tibiofemoral joint, patellofemoral joint and head of fibula.
- Mobilization of the right talocrural and subtalar joints.

Therapy applied:

- In supine position, STT was applied on the left thigh using a soft foam ball for circa 5 minutes to reduce swelling of the thigh and as stimulation around the scar to restore skin sensitivity to its original condition prior to the surgery. STT was not applied on the scar but was applied on the areas surrounding the scar.
- Ankle pump exercises to prevent DVT. In supine position, the patient was asked to actively perform dorsiflexion and plantarflexion of her ankles for a set of 30 repetitions. Afterwards she actively performed ankle circumduction where she circumducted her ankles for one set of 15 repetitions to the right side then another set of 15 repetitions to the left side.
- Diaphragmatic breathing exercise was performed to improve the stereotype of breathing and to improve stability via the diaphragm. In supine position, the patient

was asked to bend her knees with a pillow used as support under her knees. With the first hand she placed her palm over her upper chest above the sternum, below the clavicle bones. The second hand was placed on the patient's stomach. The patient was then asked to breathe slowly through her nose and into her trunk, she was also asked to maintain the hand that holding above the chest to stay still without any movements and the second arm that's on the stomach to press slightly on the abdominal wall to while also maintain the position of her hand without any movements to influence the activity and stabilization of the abdominal muscles and ensure optimal activation of the diaphragm.

- To strengthen and improve the range of motion of the left hip into flexion, extension and also abduction, first the patient was in side-lying position and as the therapist I exercised both flexion and extension ranges of motion dynamically in an active assistive method. This was repeated for 3 sets of 10 repetitions in each set. In supine position abduction was also exercised in an active assistive method for 3 sets of 10 repetitions in each set.
- To strengthen the gluteus maximus isometric contractions were used. The patient was in supine position and she was asked to contract her buttocks using maximal effort for 5 seconds then relaxed. This was repeated 3 times.
- To strengthen the core and improve its stability. In supine position, the patient was asked to bend only her knee on the non-operated limb and after that the patient was asked to slight lift her right pelvis from the table. This exercise was repeated 10 times.
- PIR according to the principles of Lewit were applied to the left lateral hamstrings (biceps femoris), right gastrocnemius muscle and left iliopsoas.
- PIR of the adductors was also performed but the position of the patient was modified because in the treatment position used by Lewit the patient has to place her hip joint in external rotation which is contraindicated. The modified position was with the patient laying in supine position. One hand was placed on the

ipsilateral hip on the SIAS to stabilize the pelvis and with the second arm grab the whole LE and go to abduction to take up the slack and perform the PIR technique.

- Release of the lower leg fasciae in the left leg into both the medial and lateral directions. Release of the fasciae of the right leg into the lateral direction.
- Joint play mobilization according to the principles of Lewit were applied to mobilize the left tibiofemoral joint into the medial direction, the left patellofemoral joint into the caudal direction, the left head of fibula into both the dorsal and ventral directions, the right talocrural joint into plantarflexion and the subtalar joint into the direction of inversion.
- The patient was also educated on how much weight (circa 50% of loading) she should bear on her operated limb.

Self therapy:

- Ankle pump exercises as in the therapy session.
- Diaphragmatic breathing exercises as in the therapy session.
- Isometric contractions of the gluteus maximus as in the therapy session.

Therapy evaluation

Subjective: As the first therapy session ended the patient felt a bit tired but the patient also felt that the pain around her hip joint was becoming better at the end of the session.

Objective: Mobility of the tissue near the scar improved at the end of the session. Joint play of the talocrural on the right side improved as well. Relaxation of both the hip adductors and lateral hamstrings was achieved after the therapy.

Notes: Due to pain in the patient's left hip joint, the patient was not able to hold her bent knee in position to perform the bridge exercise and that's why a single legged bridging exercise was rather performed. Also because in the initial kinesiological examination the patient was already mobilized from supine position and into standing it wasn't repeated again in the treatment as the patient was already tired.

Session 2

Date: 15th of January 2019.

Duration of therapy: 45 minutes.

Subjective: The patient feels energetic and ready for today's session. On a scale of 1-10 the patient describes the pain as 4 and was satisfied with the results of the previous session.

Objective: The soft tissue near the scar continues to feel softer. Testing the AROM of the hip joint in flexion, extension and abduction is shows that the movement is still weak and limited but the patient's perception of pain has decreased.

Goal of today's therapy session:

- Reduction of swelling of the left thigh.
- Reducing pain around the left hip joint.
- DVT prevention.
- Improving diaphragmatic breathing.
- Increasing the PROM of the left hip into flexion, abduction and extension.
- Strengthening the left gluteus medius and minimus.
- Strengthening the core muscles.
- Relaxation of both hip adductors, left lateral hamstrings, left iliopsoas and right gastrocnemius.
- Release of the lower leg fasciae.
- Mobilization of the left tibiofemoral joint, patellofemoral joint and head of fibula.
- Mobilization of the right talocrural and subtalar joints.
- Mobilization from bed into setting and standing.

Therapy applied:

- In supine position, STT was applied on the left thigh using a soft foam ball for circa 5 minutes to reduce swelling of the thigh and as stimulation around the scar to

restore skin sensitivity to its original condition prior to the surgery. STT was not applied on the scar but was applied on the areas surrounding the scar.

- Ankle pump exercises to prevent DVT. In supine position, the patient was asked to actively perform dorsiflexion and plantarflexion of her ankles for a set of 30 repetitions. Afterwards she actively performed ankle circumduction where she circumducted her ankles for one set of 15 repetitions to the right side then another set of 15 repetitions to the left side.
- Diaphragmatic breathing exercise was performed to improve the stereotype of breathing and to improve stability via the diaphragm. In supine position, the patient was asked to bend her knees with a pillow used as support under her knees. With the first hand she placed her palm over her upper chest above the sternum, below the clavicle bones. The second hand was placed on the patient's stomach. The patient was then asked to breathe slowly through her nose and into her trunk, she was also asked to maintain the hand that holding above the chest to stay still without any movements and the second arm that's on the stomach to press slightly on the abdominal wall to while also maintain the position of her hand without any movements to influence the activity and stabilization of the abdominal muscles and ensure optimal activation of the diaphragm.
- To strengthen and improve the range of motion of the left hip into flexion, extension and also abduction, first the patient was in side-lying position and as the therapist I controlled both flexion and extension ranges of motion dynamically in active motion without resistance. This was repeated for 3 sets of 10 repetitions in each set. In supine position active abduction was also exercised for 3 sets of 10 repetitions in each set.
- To strengthen the gluteus maximus isometric contractions were used. The patient was in supine position and she was asked to contract her buttocks maximal effort she had for 5 then relaxed. This was repeated 3 times.
- To strengthen the core and improve its stability. In supine position, the patient was asked to bend only her knee on the non-operated limb and after that the patient was

asked to slight lift her right pelvis from the table. This exercise was repeated 10 times.

- PIR according to the principles of Lewit were applied to the left lateral hamstrings (biceps femoris), right gastrocnemius muscle and left iliopsoas.
- PIR of the adductors was also performed but the position of the patient was modified because in the treatment position used by Lewit the patient has to place her hip joint in external rotation which is contraindicated. The modified position was with the patient laying in supine position. One hand was placed on the ipsilateral hip on the SIAS to stabilize the pelvis and with the second arm grab the whole LE and go to abduction to take up the slack and perform the PIR technique.
- Release of the lower leg fasciae in the left leg into both the medial and lateral directions. Release of the fasciae of the right leg into the lateral direction.
- Joint play mobilization according to the principles of Lewit were applied to mobilize the left tibiofemoral joint into the medial direction, the left patellofemoral joint into the caudal direction, the left head of fibula into both the dorsal and ventral directions, the right talocrural joint into plantarflexion and the subtalar joint into the direction of inversion.
- The last exercise for today was to mobilize the patient from bed to standing. The patient stood via the assistance of a high walker. The next step was to exercise and walk with the patient around her room and to get her back to bed safely.

Self therapy:

- Ankle pump exercises as in the therapy session.
- Diaphragmatic breathing exercises as in the therapy session.
- Isometric contractions of the gluteus maximus as in the therapy session.
- Placing an overball underneath the heel with the left knee bent at approximately 90 degrees of flexion, the patient should press into the ball with her thigh in to the overball via the heel. This provides isometric contraction of the gluteus maximus to strengthen it further.

- With the help of a theraband the patient should wrap her knees with the band and use it as resistance for an isometric contraction in abduction to strengthen the hip abductors.

Therapy evaluation

Subjective: The patient didn't feel as tired as the previous session and by the end of the session she still wanted to continue the therapy.

Objective: The patient today was able to perform motion in her hip joint actively with a decrease in the level of pain in the hip joint. She wasn't fully able to keep both her knees bent and perform a bridge exercise. While the patient was standing she felt her body being more stable with more control.

Notes: None.

Session 3

Date: 16th of January 2019.

Duration of therapy: 45 minutes.

Subjective: The patient is yet again excited to begin the therapy session for. On a scale of 1-10 the pain is still at a level 4. The patient expressed her will to train gait a bit more so she could go to the toilet and back to her bed.

Objective: The soft tissue near the scar continues to feel softer. Testing the AROM of the hip joint in flexion, extension and abduction is shows that the movement has improved more than the last session.

Goal of today's therapy session:

- Reduction of swelling of the left thigh.
- Reducing pain around the left hip joint.
- DVT prevention.

- Improving diaphragmatic breathing.
- Increasing the PROM of the left hip into flexion, abduction and extension.
- Strengthening the left gluteus medius and minimus.
- Strengthening the core muscles.
- Relaxation of both hip adductors, left lateral hamstrings, left iliopsoas and right gastrocnemius.
- Release of the lower leg fasciae.
- Mobilization of the left tibiofemoral joint, patellofemoral joint and head of fibula.
- Mobilization of the right talocrural and subtalar joints.
- Training to stand and gait.
- Weight bearing training.

Therapy applied:

- In supine position, STT was applied on the left thigh using a soft foam ball for circa 5 minutes to reduce swelling of the thigh and as stimulation around the scar to restore skin sensitivity to its original condition prior to the surgery. STT was not applied on the scar but was applied on the areas surrounding the scar.
- Ankle pump exercises to prevent DVT. In supine position, the patient was asked to actively perform dorsiflexion and plantarflexion of her ankles for a set of 30 repetitions. Afterwards she actively performed ankle circumduction where she circumducted her ankles for one set of 15 repetitions to the right side then another set of 15 repetitions to the left side.
- Diaphragmatic breathing exercise was performed to improve the stereotype of breathing and to improve stability via the diaphragm. In supine position, the patient was asked to bend her knees with a pillow used as support under her knees. With the first hand she placed her palm over her upper chest above the sternum, below the clavicle bones. The second hand was placed on the patient's stomach. The patient was then asked to breathe slowly through her nose and into her trunk, she was also asked to maintain the hand that holding above the chest to stay still without

any movements and the second arm that's on the stomach to press slightly on the abdominal wall to while also maintain the position of her hand without any movements to influence the activity and stabilization of the abdominal muscles and ensure optimal activation of the diaphragm.

- To strengthen and improve the range of motion of the left hip into flexion, extension and also abduction, first the patient was in side-lying position and as the therapist I controlled both flexion and extension ranges of motion dynamically in active motion without resistance. This was repeated for 3 sets of 10 repetitions in each set. In supine position active abduction was also exercised for 3 sets of 10 repetitions in each set.
- To strengthen the gluteus maximus isometric contractions were used. The patient was in supine position and she was asked to contract her buttocks maximal effort she had for 5 then relaxed. This was repeated 3 times.
- Bridging exercise was used to strengthen the core and improve its stability. In supine position, the patient was asked to bend both her knee and then the patient was asked to lift her pelvis from the table and try to level her trunk, pelvis and bent knee all together in one line. This exercise was repeated 10 times.
- PIR according to the principles of Lewit were applied to the left lateral hamstrings (biceps femoris), right gastrocnemius muscle and left iliopsoas.
- PIR of the adductors was also performed but the position of the patient was modified because in the treatment position used by Lewit the patient has to place her hip joint in external rotation which is contraindicated. The modified position was with the patient laying in supine position. One hand was placed on the ipsilateral hip on the SIAS to stabilize the pelvis and with the second arm grab the whole LE and go to abduction to take up the slack and perform the PIR technique.
- Release of the lower leg fasciae in the left leg into both the medial and lateral directions. Release of the fasciae of the right leg into the lateral direction.
- Joint play mobilization according to the principles of Lewit were applied to mobilize the left tibiofemoral joint into the medial direction, the left patellofemoral

joint into the caudal direction, the left head of fibula into both the dorsal and ventral directions, the right talocrural joint into plantarflexion and the subtalar joint into the direction of inversion.

- The last exercise for today was to mobilize the patient from bed to standing. The patient stood via the assistance of a high walker. The next step was to exercise and walk with the patient around her room and also to walk outside her room in the corridors of the orthopedic surgery department.
- As the patient was standing the amount of weight she bears was controlled to ensure her safety.

Self therapy:

- Ankle pump exercises as in the therapy session.
- Diaphragmatic breathing exercises as in the therapy session.
- Isometric contractions of the gluteus maximus as in the therapy session.
- Placing an overball underneath the heel with the left knee bent at approximately 90 degrees of flexion, the patient should press into the ball with her thigh in to the overball via the heel. This provides isometric contraction of the gluteus maximus to strengthen it further. At the end of the exercise the patient switches her leg.
- The patient with the use of an overball underneath her heel could press on the ball and roll it on bed. This is to exercise both active flexion and extension of the hip. In this exercise the patient should go in to the maximum hip extension and flexion she can perform without exceeding 90 degrees of hip flexion.
- With the help of a theraband the patient should wrap her knees with the band and use it as resistance for an isometric contraction in abduction to strengthen the hip abductors.

Therapy evaluation

Subjective: The patient feels more confident while standing.

Objective: The patient is more stable in standing and walking.

Notes: None.

Session 4

Date: 17th of January 2019.

Duration of therapy: 45 minutes.

Subjective: Today the patient is expressing her will to try and exercise gait using French crutches. On a scale of 1-10 she describes her pain at a level 3.

Objective: The patient has more control of the movement in her hip joint and the level of pain she felt has decreased. Today the swelling around the thigh has also decreased. With the help of a measuring tape it was shown that the left thigh went from 47 cm (15 cm above the patella) and 45 cm (10 cm above the patella) 45 cm and 43 cm respectively.

Goal of today's therapy session:

- Reduction of swelling of the left thigh.
- Reducing pain around the left hip joint.
- DVT prevention.
- Improving diaphragmatic breathing.
- Increasing the PROM of the left hip into flexion, abduction and extension.
- Strengthening the left gluteus medius and minimus.
- Strengthening the core muscles.
- Relaxation of both hip adductors, left lateral hamstrings, left iliopsoas and right gastrocnemius.
- Release of the lower leg fasciae.
- Mobilization of the left tibiofemoral joint, patellofemoral joint and head of fibula.
- Mobilization of the right talocrural and subtalar joints.
- Gait training with French crutches.

Therapy applied:

- In supine position, STT was applied on the left thigh using a soft foam ball for circa 5 minutes to reduce swelling of the thigh and as stimulation around the scar to restore skin sensitivity to its original condition prior to the surgery. STT was not applied on the scar but was applied on the areas surrounding the scar.
- Ankle pump exercises to prevent DVT. In supine position, the patient was asked to actively perform dorsiflexion and plantarflexion of her ankles for a set of 30 repetitions. Afterwards she actively performed ankle circumduction where she circumducted her ankles for one set of 15 repetitions to the right side then another set of 15 repetitions to the left side.
- Diaphragmatic breathing exercise was performed to improve the stereotype of breathing and to improve stability via the diaphragm. In supine position, the patient was asked to bend her knees with a pillow used as support under her knees. With the first hand she placed her palm over her upper chest above the sternum, below the clavicle bones. The second hand was placed on the patient's stomach. The patient was then asked to breathe slowly through her nose and into her trunk, she was also asked to maintain the hand that holding above the chest to stay still without any movements and the second arm that's on the stomach to press slightly on the abdominal wall to while also maintain the position of her hand without any movements to influence the activity and stabilization of the abdominal muscles and ensure optimal activation of the diaphragm.
- To strengthen and improve the range of motion of the left hip into flexion, extension and also abduction, first the patient was in side-lying position and as the therapist I controlled both flexion and extension ranges of motion dynamically in active motion without resistance. This was repeated for 3 sets of 10 repetitions in each set. In supine position active abduction was also exercised for 3 sets of 10 repetitions in each set.
- To strengthen the gluteus maximus isometric contractions were used. The patient was in supine position and she was asked to contract her buttocks maximal effort

she had for 5 then relaxed. This was repeated 3 times. Followed the isometric contractions the patient placed an overball below her heel (one heel at a time) and then rolled the overball away from her body. Starting position is with semi flexed knee then she has to extend her hip while pressing her heel into the overball. This was repeated with 3 set of ten repetitions.

- Bridging exercise was used to strengthen the core and to improve its stability. In supine position, the patient was asked to bend both her knees and then the patient was asked to lift her pelvis from the table and try to level her trunk, pelvis and knees all together in one plane. This exercise was repeated 15 times.
- PIR according to the principles of Lewit were applied to the left lateral hamstrings (biceps femoris), right gastrocnemius muscle and left iliopsoas.
- PIR of the adductors was also performed but the position of the patient was modified because in the treatment position used by Lewit the patient has to place her hip joint in external rotation which is contraindicated. The modified position was with the patient laying in supine position. One hand was placed on the ipsilateral hip on the SIAS to stabilize the pelvis and with the second arm grab the whole LE and go to abduction to take up the slack and perform the PIR technique.
- Release of the lower leg fasciae in the left leg into both the medial and lateral directions. Release of the fasciae of the right leg into the lateral direction.
- Joint play mobilization according to the principles of Lewit were applied to mobilize the left tibiofemoral joint into the medial direction, the left patellofemoral joint into the caudal direction, the left head of fibula into both the dorsal and ventral directions, the right talocrural joint into plantarflexion and the subtalar joint into the direction of inversion.
- The last exercise for today was to educate the patient on how to use French crutches and to train her weight bearing on the operated limb.

Self therapy:

- Ankle pump exercises as in the therapy session.
- Diaphragmatic breathing exercises as in the therapy session.
- Isometric contractions of the gluteus maximus as in the therapy session.
- Placing an overball underneath the heel with the left knee bent at approximately 90 degrees of flexion, the patient should press into the ball with her thigh in to the overball via the heel. This provides isometric contraction of the gluteus maximus to strengthen it further. At the end of the exercise the patient switches her leg.
- The patient with the use of an overball underneath her heel could press on the ball and rolled it on bed. This is to exercise both active flexion and extension of the hip. In this exercise the patient should go in to the maximum hip extension and flexion she can perform without exceeding 90 degrees of hip flexion.
- With the help of a theraband the patient should wrap her knees with the band and use it as resistance for an isometric contraction in abduction to strengthen the hip abductors.

Therapy evaluation

Subjective: The patient was happy that she was able to walk using French crutches instead of a walker

Objective: While the patient is walking the patient is able to hold her pelvis without dropping to the lateral side for a few minutes until she gets tired and her pelvis begins to drop again.

Notes: None.

Session 5

Date: 18th of January 2019.

Duration of therapy: 45 minutes.

Subjective: Today the patient feels tired but she is willing to exercise and improve her condition. On a scale of 1-10 the patient describes the level of pain at a level 2.

Objective: The patient has more control of the movement in her hip joint and the level of pain she felt has decreased.

Goal of today's therapy session:

- Reduction of swelling of the left thigh.
- Reducing pain around the left hip joint.
- DVT prevention.
- Improving diaphragmatic breathing.
- Increasing the PROM of the left hip into flexion, abduction and extension.
- Strengthening the left gluteus medius and minimus.
- Strengthening the core muscles.
- Relaxation of both hip adductors, left lateral hamstrings, left iliopsoas and right gastrocnemius.
- Release of the lower leg fasciae.
- Mobilization of the left tibiofemoral- joint, patellofemoral joint and head of fibula.
- Mobilization of the right talocrural and subtalar joints.

Therapy applied:

- In supine position, STT was applied on the left thigh using a soft foam ball for circa 5 minutes to reduce swelling of the thigh and as stimulation around the scar to restore skin sensitivity to its original condition prior to the surgery. STT was not applied on the scar but was applied on the areas surrounding the scar.
- Ankle pump exercises to prevent DVT. In supine position, the patient was asked to actively perform dorsiflexion and plantarflexion of her ankles for a set of 30 repetitions. Afterwards she actively performed ankle circumduction where she circumducted her ankles for one set of 15 repetitions to the right side then another set of 15 repetitions to the left side.

- Diaphragmatic breathing exercise was performed to improve the stereotype of breathing and to improve stability via the diaphragm. In supine position, the patient was asked to bend her knees with a pillow used as support under her knees. With the first hand she placed her palm over her upper chest above the sternum, below the clavicle bones. The second hand was placed on the patient's stomach. The patient was then asked to breathe slowly through her nose and into her trunk, she was also asked to maintain the hand that holding above the chest to stay still without any movements and the second arm that's on the stomach to press slightly on the abdominal wall to while also maintain the position of her hand without any movements to influence the activity and stabilization of the abdominal muscles and ensure optimal activation of the diaphragm.
- To strengthen and improve the range of motion of the left hip into flexion, extension and also abduction, first the patient was in side-lying position and as the therapist I controlled both flexion and extension ranges of motion dynamically in active motion without resistance. This was repeated for 3 sets of 10 repetitions in each set. In supine position active abduction was also exercised for 3 sets of 10 repetitions in each set. Therabands were used as well to add more resistance to the motions.
- To strengthen the gluteus maximus isometric contractions were used. The patient was in supine position and she was asked to contract her buttocks with maximal effort she had for 5 seconds then relaxed. This was repeated 3 times. Followed the isometric contractions the patient placed an overball below her heel (one heel at a time) and then rolled the overball away from her body. Starting position is with semi flexed knee then she has to extend her hip while pressing her heel into the overball. This was repeated with 3 set of ten repetitions.
- Bridging exercise was used to strengthen the core and to improve its stability. In supine position, the patient was asked to bend both her knees and then the patient was asked to lift her pelvis from the table and try to level her trunk, pelvis and knees all together in one plane. This exercise was repeated 15 times.

- PIR according to the principles of Lewit were applied to the left lateral hamstrings (biceps femoris), right gastrocnemius muscle and left iliopsoas.
- PIR of the adductors was also performed but the position of the patient was modified because in the treatment position used by Lewit the patient has to place her hip joint in external rotation which is contraindicated. The modified position was with the patient laying in supine position. One hand was placed on the ipsilateral hip on the SIAS to stabilize the pelvis and with the second arm grab the whole LE and go to abduction to take up the slack and perform the PIR technique.
- Release of the lower leg fasciae in the left leg into both the medial and lateral directions. Release of the fasciae of the right leg into the lateral direction.
- Joint play mobilization according to the principles of Lewit were applied to mobilize the left tibiofemoral joint into the medial direction, the left patellofemoral joint into the caudal direction, the left head of fibula into both the dorsal and ventral directions, the right talocrural joint into plantarflexion and the subtalar joint into the direction of inversion.

Self therapy:

- Ankle pump exercises as in the therapy session.
- Diaphragmatic breathing exercises as in the therapy session.
- Isometric contractions of the gluteus maximus as in the therapy session.
- Placing an overball underneath the heel with the left knee bent at approximately 90 degrees of flexion, the patient should press into the ball with her thigh in to the overball via the heel. This provides isometric contraction of the gluteus maximus to strengthen it further. At the end of the exercise the patient switches her leg.
- The patient with the use of an overball underneath her heel could press on the ball and roll it on bed. This is to exercise both active flexion and extension of the hip. In this exercise the patient should go in to the maximum hip extension and flexion she can perform without exceeding 90 degrees of hip flexion.

- With the help of a theraband the patient should wrap her knees with the band and use it as resistance for an isometric contraction in abduction to strengthen the hip abductors.

Therapy evaluation

Subjective: The patient felt exhausted by the end of the therapy and due to this the patient didn't train her gait.

Objective: The patient felt less after the therapy. The AROM of flexion, extension and abduction of the hip has also improved. Tonicity of the hamstrings and hip adductors has also decreased. Joint play of the left head of fibula and also right talocrural joint has also improved.

Notes: Today I wanted to educate the patient onto how to use the French crutches and train with crutches going up and down the stairs as she lives in a 2 floor home.

Session 6

Date: 21st of January 2019.

Duration of therapy: 45 minutes.

Subjective: So far the patient has been happy and proud of the improvements she had. On a scale of 1-10 the patient describes the level of pain at a level 2.

Objective: The patient has more control of the movement in her hip joint and the level of pain she felt has decreased.

Goal of today's therapy session:

- Reduction of swelling of the left thigh.
- Reducing pain around the left hip joint.
- DVT prevention.
- Improving diaphragmatic breathing.

- Increasing the PROM of the left hip into flexion, abduction and extension.
- Strengthening the left gluteus medius and minimus.
- Strengthening the core muscles.
- Relaxation of both hip adductors, left lateral hamstrings, left iliopsoas and right gastrocnemius.
- Release of the lower leg fasciae.
- Mobilization of the left tibiofemoral joint, patellofemoral joint and head of fibula.
- Mobilization of the right talocrural and subtalar joints.
- Gait training with French crutches to climb up and down the stairs.

Therapy applied:

- In supine position, STT was applied on the left thigh using a soft foam ball for circa 5 minutes to reduce swelling of the thigh and as stimulation around the scar to restore skin sensitivity to its original condition prior to the surgery. STT was not applied on the scar but was applied on the areas surrounding the scar.
- Ankle pump exercises to prevent DVT. In supine position, the patient was asked to actively perform dorsiflexion and plantarflexion of her ankles for a set of 30 repetitions. Afterwards she actively performed ankle circumduction where she circumducted her ankles for one set of 15 repetitions to the right side then another set of 15 repetitions to the left side.
- Diaphragmatic breathing exercise was performed to improve the stereotype of breathing and to improve stability via the diaphragm. In supine position, the patient was asked to bend her knees with a pillow used as support under her knees. With the first hand she placed her palm over her upper chest above the sternum, below the clavicle bones. The second hand was placed on the patient's stomach. The patient was then asked to breathe slowly through her nose and into her trunk, she was also asked to maintain the hand that holding above the chest to stay still without any movements and the second arm that's on the stomach to press slightly on the abdominal wall to while also maintain the position of her hand without any

movements to influence the activity and stabilization of the abdominal muscles and ensure optimal activation of the diaphragm.

- To strengthen and improve the range of motion of the left hip into flexion, extension and also abduction, first the patient was in side-lying position and as the therapist I controlled both flexion and extension ranges of motion dynamically in active motion without resistance. This was repeated for 3 sets of 10 repetitions in each set. In supine position active abduction was also exercised for 3 sets of 10 repetitions in each set. Therabands were used as well to add more resistance to the motions.
- To strengthen the gluteus maximus isometric contractions were used. The patient was in supine position and she was asked to contract her buttocks maximal effort she had for 5 then relaxed. This was repeated 3 times. Followed the isometric contractions the patient placed an overball below her heel (one heel at a time) and then rolled the overball away from her body. Starting position is with semi flexed knee then she has to extend her hip while pressing her heel into the overball. This was repeated with 3 set of ten repetitions.
- Bridging exercise was used to strengthen the core and to improve its stability. In supine position, the patient was asked to bend both her knees and then the patient was asked to lift her pelvis from the table and try to level her trunk, pelvis and knees all together in one plane. This exercise was repeated 15 times.
- PIR according to the principles of Lewit were applied to the left lateral hamstrings (biceps femoris), right gastrocnemius muscle and left iliopsoas.
- PIR of the adductors was also performed but the position of the patient was modified because in the treatment position used by Lewit the patient has to place her hip joint in external rotation which is contraindicated. The modified position was with the patient laying in supine position. One hand was placed on the ipsilateral hip on the SIAS to stabilize the pelvis and with the second arm grab the whole LE and go to abduction to take up the slack and perform the PIR technique.
- Release of the lower leg fasciae in the left leg into both the medial and lateral directions. Release of the fasciae of the right leg into the lateral direction.

- Joint play mobilization according to the principles of Lewit were applied to mobilize the left tibiofemoral joint into the medial direction, the left patellofemoral joint into the caudal direction, the left head of fibula into both the dorsal and ventral directions, the right talocrural joint into plantarflexion and the subtalar joint into the direction of inversion.
- The last exercise for today was to educate the patient on how to use French crutches to climb up and down the stairs.
- The patient was also educated on how to take care of her scar once the stitches were removed. She was also educated on how to perform ADL with crutches. She was also informed about her current state, prognosis and demands to recovery optimally.

Self therapy:

- Ankle pump exercises as in the therapy session.
- Diaphragmatic breathing exercises as in the therapy session.
- Isometric contractions of the gluteus maximus as in the therapy session.
- Placing an overball underneath the heel with the left knee bent at approximately 90 degrees of flexion, the patient should press into the ball with her thigh in to the overball via the heel. This provides isometric contraction of the gluteus maximus to strengthen it further. At the end of the exercise the patient switches her leg.
- The patient with the use of an overball underneath her heel could press on the ball and roll it on bed. This is to exercise both active flexion and extension of the hip. In this exercise the patient should go in to the maximum hip extension and flexion she can perform without exceeding 90 degrees of hip flexion.
- With the help of a theraband the patient should wrap her knees with the band and use it as resistance for an isometric contraction in abduction to strengthen the hip abductors.

Therapy evaluation

Subjective: Since today was the first time for the patient to use crutches while walking up and down stairs after the surgery, the patient adapted very quickly on how to use French crutches.

Objective: Pain was felt a lot less after therapy. The AROM of flexion, extension and abduction of the hip has also improved. Tonicity of the hamstrings and hip adductors has also decreased. Joint play of the left head of fibula and also right talocrural joint has also improved.

Notes: Today was my last session with the patient and from tomorrow the patient would be hospitalized in a different hospital in Prague.

3.6 Final kinesiological examination

3.6.1 Static postural examination (the patient was supported with French crutches)

Posterior view

Table 18 Final posterior postural view

The base of support:	Narrow base of support. Both feet are enclosed within a 30° angle.
Shape and contour of the heels:	Normal shape and contour of both heels.
Shape and position of the ankle joints:	Pronation of the right ankle.
Shape and thickness of the Achilles tendons:	Normal shape of both the Achilles tendons.
Contour of the calf muscles:	Normal contour and symmetry in both legs.
Shape and position of the knee joints:	The left knee is slightly externally rotated. The right knee is in internal rotation.
Popliteal line:	The right popliteal line is higher than the left popliteal line.
Contour of the thigh muscles:	Normal contour and symmetry in both legs.
Subgluteal line:	The right subgluteal line is higher than the left subgluteal line.
Gluteal muscles:	Slight atrophy of the gluteal muscles on the left side.
Symmetry of the thoracobrachial triangles:	The right thoracobrachial triangle is bigger than the left triangle.
Position of the pelvis:	Anterior pelvic tilt and left lateral pelvic tilt.
Paravertebral muscles:	No muscular abnormality.
Curvature of the spine in the frontal plane:	Slight lateral curvature of the spine to the left side with the top of the curve being at Th10-Th11.
Position of the scapula:	Both scapulae.
Position of the upper limb:	Optimal without any rotations.
Position and contour of the nuchal muscles:	The left trapezius muscle is higher and it's also more prominent.
Position of the head:	Lateral tilt to the right.

Lateral view

Table 19 Final lateral postural view

Weight distribution	The weight is distributed medially on both sides .
Shape and position of the ankle joints	The right ankle is pronated.
Shape and contour of the shin	Normal shape and symmetry in both sides.
Position of the knee joints	The left knee is slightly externally rotated. The right knee is in internal rotation with full extension.
Contour of the thigh muscles	The muscles on the right thigh appear to be more prominent than the left side especially on the lateral side.
Position of the pelvis	The pelvis is tilted anteriorly.
Position and curvature of the spine	Increased lumbar lordosis.
Shape of the abdominal muscles	Optimal shape.
Position of the shoulder girdles	Both shoulders are protracted.
Position of the head	The head is slightly protracted.

Anterior view

Table 20 Final anterior postural view

The base of support:	Narrow base of support. Both feet are enclosed within a 30° angle.
The position of the feet:	The right foot is pronated.
The position and shape of the toes:	Halux valgus was present on both feet.
Weight distribution:	The weight is distributed medially.
Shape and position of the knee joints:	The left knee is slightly externally rotated. The right knee is in internal rotation.
Configuration of the tibialis anterior muscle:	Symmetrical on both sides.
Contour of the anterior compartment muscles of the lower leg:	Symmetrical on both sides
Position of the pelvis:	Anterior pelvic tilt and left lateral pelvic tilt.
Muscle tone symmetry of the abdominal muscles:	Slight activity of the abdominal muscles without bulging.
Position of the umbilicus:	The umbilicus is slightly pulled to the left side.
Symmetry of the thoracobrachial triangles:	The right thoracobrachial triangle is bigger than the left triangle.
Position and symmetry of the chest:	The chest is symmetrical without any deformities.
Position of the sternum:	Optimal position without any rotations.
Position of the collarbones and superclavicular holes:	Both the collarbones and the superclavicular holes are in optimal position.
Position of the shoulder girdle:	The left shoulder is elevated plus both shoulders are protracted.
Position of the upper limbs:	Optimal without any rotations.
Position of the head:	Lateral tilt to the right.

3.6.2 Palpation of pelvis

- Height and symmetry of cristae iliacae: The right crista iliaca is higher.
- Height and symmetry of SIPSs: The right SIPSs is higher.
- Height and symmetry of SIASs: The right SIASs is higher.

- Position of the pelvis: The pelvis is in anteversion position with a lateral tilt to the left side.

3.6.3 Assessment of stereotype of breathing

Table 21 Final breathing assesment

Position	Standing	Sitting	Laying
Position of the trunk	The chest is in an inspiratory position with the sternum going crainally when the patient is sitting and laying down.		
Shape of the trunk	Normal shape in all positions.		
Frequency	12	11	11
Intensity	The breathing rhythm is more intense in standing.		
Mobility of trunk, abdomen, shoulders and head	Decreased mobility of the trunk, shoulders and head during standing and while their mobility increases in sitting laying position.		
Activity of accessory muscles	No shown reaction of activity of the accessory muscles.		
Breathing type	Abdominal	Both abdominal and lower trunk.	Both abdominal and lower trunk.

3.6.4 Specific Testing of posture

- Véle test: Grade 1.

3.6.5 Anthropometric measurements (Measured using a “Linen Measuring Tape”)

Table 22 Final anthropometric measurements

Height measurements	In standing	In sitting	Arm span
	165 cm	86 cm	158 cm
The anatomical length	Left side 81 cm	Right side 79 cm	
The functional length	From SIAS to malleolus medialis Left side 87 cm	Right side 85.5 cm	
	From umbilicus to malleolus medialis Left side 92.5 cm	Right side 91 cm	
The length of the thigh	Left side 41 cm	Right side 40 cm	
The length of the middle leg	Left side 35 cm	Right side 35 cm	
The length of the foot	Left side 23 cm	Right side 23 cm	
The circumference of the thigh	15 cm above the knee cap Left side 44 cm	Right side 41 cm	
	10 cm above the knee cap Left side 42 cm	Right side 40 cm	
The circumference of the knee joint	Left side 38 cm	Right side 37 cm	
The circumference of the calf	Left side 34 cm	Right side 34 cm	
The circumference of the ankle	Left side 26 cm	Right side 26 cm	
The circumference of the foot	Left side 22 cm	Right side 22 cm	
The circumference of the thorax	In the middle of the sternum: 72 cm maximal exhalation, 80 cm normal position and 83 cm maximal inhalation. In the height of process xiphoid: 67 cm maximal exhalation, 70 cm normal position and 75 cm maximal inhalation.		
The circumference of the waist	67 cm		
The circumference of the hips	99 cm		
The width dimensions	Biacromial: 42 cm Bicristal: 45 cm Bispinal: 29 cm Bitrochanterical: 44 cm		

3.6.6 Gait analysis (the patient was supported with French crutches)

Table 23 Final gait analysis

Width of the base of support	Narrow base of support.
Walking rhythm	Unsymmetrical with the patient moving faster with her right leg.
Walking speed	The speed in both extremities is slow, slower on the left side.
Stride length	Symmetrical length on both sides.
Movement of the foot	
➤ Heel strike	Optimal on both sides.
➤ Flat foot	Present on the right foot.
➤ Loading response	Optimal response is absent on both sides.
➤ Heel off	Optimal on both sides.
➤ Toe off	Optimal on both sides.
Movement and position of the knee and hip	On the the left hip flexion is greater than hip extension. The patient extends her hip slightly.
Position and movement of the pelvis	The pelvis is in a slightly anterior tilt position without the pelvis dropping to the left side.
Movement of center of gravity	The patient is stable.
Position and movements of the trunk	The trunk is slightly bent forward.
Position of the spine	No rotations of the spine were found.
Activity of the back muscles	Normal activity was shown.
Activity of the abdominal muscles:	Minimal activity was shown.
Position of the shoulders	Shoulders were slightly protracted.
Position and movements of the head	The head was slightly protracted.
Movements of the upper extremity	Wasn't clearly shown due to the support of the crutches.
Stability of walking	The patient walks steadily with the support of French crutches.

Typology of Gait according to Janda: Distal gait pattern.

3.6.7 Measurement of range of motion (SFTR format, goniometry according to Janda)

Table 24 Final measurement of range of motion

	AROM		PROM	
	Left	Right	Left	Right
Hip joint	S 10-0-60	S 10-0-105	S 15-0-75	S 10-0-110
	F 20-0-CI	F 30-0-15	F 30-0-CI	F 35-0-20
	R CI-0-15	R 20-0-35	R CI-0-20	R 30-0-45
Knee joint	S 0-0-105	S 0-0-110	S 0-0-110	S 0-0-115
Ankle joint	S 20-0-50	S 20-0-50	S 40-0-50	S 30-0-50
	R 15-0-30	R 25-0-25	R 20-0-40	R 25-0-30

3.6.8 Joint end feel and joint play examination (Lewit approach)

Table 25 Final joint play examination

Joint	Left		Right	
	End Feel	Joint Play	End Feel	Joint Play
Tibiofemoral	Firm.	Free.	Firm.	Free.
Patellofemoral	Firm.	Free.	Firm.	Free.
Head of fibula	Firm	Restricted into the ventral direction.	Soft.	Free.
Talocrural	Firm.	Free.	Firm.	Free
Subtalar	Firm.	Free.	Firm.	Free.
Lisfranc & Chopart	Firm.	Free.	Firm.	Free.
MTP	Firm.	Free.	Firm.	Free.

3.6.9 Examination of shorted muscles (according to Janda)

Table 26 Final muscle length assessment

Muscle	Left	Right
Test for length of triceps surae muscle	Grade 1	Grade 0
Test for length of hip adductor muscles	Grade 0	Grade 1
Test for length of hamstring muscles	Grade 1	Grade 1

Muscle length examination for the hip flexors, hip abductors and piriformis muscles weren't possible to be performed as the testing positions for these muscles required the patient to have her hip joint in a position that is contraindicated by the surgeon.

3.6.10 Manual muscle strength testing (according to Kendall)

Table 27 Final manual muscle strength testing

Muscle	Right	Left
Gluteus maximus	7	4
Iliopsoas (with emphasis on psoas major)	6	4
Quadriceps femoris	7	5
Hip flexors as group	6	4
Hip adductors	6	4
Gluteus minimus	7	5
Gluteus medius	7	5
External rotators	7	5
Medial hamstring	8	5
Lateral hamstring	8	6
Triceps surae	8	8
Soleus	8	8
Gastrocnemius, plantaris, Peroneus longus and peroneus brevis	8	8
Tibialis posterior	8	9
Tibialis anterior	8	6

Muscle strength testing of the quadriceps femoris, hip flexors as group, hip adductors, external rotators of the hip and lateral hamstrings were not tested according to the standard methodology of Kendall as the testing positions for these muscles required the patient to have her hip joint in a position that is contraindicated by the surgeon. To test these muscles I modified the positions to meet the patient's condition, therefore possible faulty errors should be taken into consideration.

According to Kendall to test the quadriceps femoris the patient is supposed to be sitting on the table with her knees over the side of the table. Instead of sitting, the patient was laying in supine position with her knee at the edge of the table and leg being outside the table allowing the knee joint to be extended and flexed without any flexion of the hip.

Testing the hip flexors as a group according to Kendall, the patient has to be sitting on the table with her knees over the side of the table, similarly as for testing the quadriceps femoris. Here again the patient was instead in supine position with her knee at the edge of the table and the patient was asked to flex her hip and hold from that position. The patient was also placed into side lying to further assist the left hip flexors in antigravity position.

Testing the hip adductors according to Kendall the patient requires the patient to be in side lying on the tested. For the side leg that's not tested the patient places it in abduction with the help of the therapist and the tested goes too adduction and the therapist resists. Instead of this position, the patient was placed in supine position and the operated leg of the patient.

For testing the external rotators of the hip according to Kendall, the patient has to be sitting on the table with her knees over the side of the table. Here again the patient was instead in supine position with her knee at the edge of the table and the patient was asked to try and perform external rotation while holding the test position.

To test the lateral hamstrings according to Kendall, on prone position, the patient should have her knee flexed for about 60° and the thigh being in slight external rotation. The position that was used didn't involve the patient to place her hip in external rotation.

3.6.11 Palpations

Table 28 Final palpations

Muscle	Muscle tone		Pain – MO, MI, MB	
	Left	Right	Left	Right
Rectus abdominis	Normal tone	Normal tone	No pain	No pain
Iliopsoas	Hypertonic	Normal tone	Muscle belly	No pain
Gluteal maximus	Hypotonic	Normal tone	No pain	No pain
Piriformis	Normal tone	Normal tone	No pain	No pain
Abductor muscles	Normal tone	Normal tone	No pain	No pain
Adductor muscles	Normal tone	Normal tone	No pain	No pain
Hamstrings	Normal tone	Normal tone	No pain	No pain
Quadriceps muscles	Hypotonic	Normal tone	No pain	No pain
Gastrocnemius	Normal tone	Normal tone	No pain	No pain

3.6.12 Scar examination (observation only)

The patient at the moment of the examination has 2 scars on the left lower extremity.

The first scar is located on anterolateral aspect of the left thigh above the greater trochanter. The scar is circa 11 cm long.

The second scar is located on the lateral epicondyle of tibia on the lateral aspect of the thigh. The scar stretches for about 4 cm in length.

In both scars the stitches are still unremoved since both scars are 10 days old. There are signs no of inflammation or warmth near both scars. Slight swelling is present around the scar and the whole thigh. The skin around both scars feels soft upon palpation. The patient's sensation near the first scar is decreased.

3.6.13 Fasciae examination

Table 29 Final fasciae examination

Fascia	Left	Right
Upper leg	No restrictions in both medial and lateral directions.	No restrictions in both medial and lateral directions.
Lower leg	Slight restriction in the medial direction.	No restrictions in both medial and lateral directions.
Achilles tendon	No restrictions in both medial and lateral directions.	No restrictions in both medial and lateral directions.

3.6.14 Deep system stabilizers examination

The Australian School Approach:

- Multifidi palpation: The patient wasn't able to contract the multifidi muscles properly in the segments L4-L5 and on the left side of the spine along all of the cervical spine, palpation was not painful for the patient.
- Transversus abdominis: Negative sign, the abdominal wall were flattened.

Prof. Kolář Approach:

- Extension test: Positive sign, the patient was activating her paravertebral muscles significantly around the lumbar area. Support was on the umbilicus. There was an excessive activity of the hamstrings.
- Trunk diaphragm test: Negative sign, the diaphragm activity was visible during aspection and the patient was able to activate the diaphragm against pressure. No other signs disturbances.

3.6.15 Neurological assessment

History: The patient has no neurological history in neurology without any neurological diseases also in her family.

Mental status

Consciousness:

The patient is fully conscious and aware of her surrounding environment, place, time and current situation with no other signs of altered consciousness or coma. Scored 15 (maximum) according to the *Glasgow Coma Scale*.

Higher cerebral function:

The patient is able to communicate freely and recall from both her recent and remote memories with no problems. The patient can solve everyday problems corresponding to both her personal and professional lives with no emotional disturbances such as anxiety or depression.

Scalp and skull: No deformities, scars or tenderness were present.

Examination of the neck

Cervical column: Normal mobility during active and passive movements.

Carotid arteries: Symmetrical with no disturbances.

Examination of the upper limbs

Appearance: Normal physiological appearance without any deformities, asymmetries etc.

Palpation: Optimal muscle tonus.

Mobility:

Optimal mobility in joints of the upper extremity with the ability to perform all sorts of active and passive movements.

Power: Optimal power output.

Deep reflexes:

- **Biceps reflex (C5):** Normal
- **Radial reflex (C6):** Normal

- **Triceps reflex (C7):** Normal
- **Finger jerk (C8):** Normal

Cerebellar examination: The patient is able to touch her nose with her finger.

Elementary postural reflexes: Negative.

Examination of the abdomen

- **Epigastric (T7-8):** Positive
- **Mesogastric (T9-10):** Positive
- **Hypogastric (T11-12):** Positive

Examination of the lower limbs

Appearance:

Swelling is present on the left lower extremity. The swelling is mainly spreading on the anterior and lateral aspect of the thigh from around the hip joint till about the knee joint. Two surgical scars are also present.

Palpation:

Decreased tone of the gluteus maximus and quadriceps muscles. Increased tone of the adductor muscles, hamstrings and the left gastrocnemius muscles.

Mobility:

Decreased mobility in joints of the hip joint with disturbed ability to perform some of the active and passive movements of the lower extremity.

Power: Decreased power output.

Deep reflexes

- **Patellar reflex (L2-4):** Normal
- **Achilles tendon reflex (L5-S2):** Normal
- **Medioplantar reflex (L5-S2):** Normal

Cerebellar examination:

The patient was able to complete the heel to chin test on the right and failed on the left side due to surgical restrictions.

Elementary postural reflexes: Negative

Examination of dermatomes of both lower extremities:

Table 30 Final sensation of the lower extremity

Dermatome	Left	Right
Dermatome of L1 segment	Normal sensation	Normal sensation
Dermatome of L2 segment	Normal sensation	Normal sensation
Dermatome of L3 segment	Normal sensation	Normal sensation
Dermatome of L4 segment	Normal sensation	Normal sensation
Dermatome of L5 segment	Normal sensation	Normal sensation
Dermatome of S1 segment	Normal sensation	Normal sensation
Dermatome of S2 segment	Normal sensation	Normal sensation

3.6.17 Final kinesiological examination conclusion

Similarly to the initial examination the patient still shows some of the same kinesiological changes found in the initial examination. The anterior tilt of the pelvis, LE being rotated from the pelvis and the pronation of the right foot were all still present at the time of the final examination.

Examination results that were different from the initial examination compared with the final examination were that the patient was no longer dropping her pelvis walk she was walking. Another finding was that the patient is able to extend her hip when she's walking and also her knee is no longer in a semi flexed position. Also the ankle joint was no longer partially in plantar flexion. In the initial exam muscles that surrounded the pelvis were hypotonic with the more distal muscle (including the iliopsoas and hip adductors) being more hypertonic by the time of the final examination most of the tonus disbalances have improved. The pain level that the patient was perceiving has also improved in comparison from start to end. The patient no longer uses an antalgic gait to walk and her center of gravity is quite stable plus her left thigh is slightly swollen without any signs of scar complications.

Further details of the differences in the initial and final exams are in section 3.7.

3.7 Evaluation of the effect of the therapy

3.7.1 Pain level

Table 31 Pain comparison

Session 1	5/10
Session 6	2/10

If we compare the pain level experienced by the patient prior the first session and after last session we could see that the patient is experiencing less pain in the area around her hip joint and while moving her body around.

3.7.2 Static postural examination

Posterior View

Table 32 Posterior postural view comparison

Shape and position of the ankle joints:	Initial: Pronation of the right ankle. Partial plantarflexion of the left ankle.
	Final: Pronation of the right ankle.
Shape and thickness of the Achilles tendons:	Initial: Normal shape of the Achilles tendon of the right leg. On the left leg the Achilles tendon appears to be shorter.
	Final: Normal shape of both the Achilles tendons.
Contour of the calf muscles:	Initial: The left calf appears to be wider than right calf.
	Final: Normal contour and symmetry in both legs.
Shape and position of the knee joints:	Initial: The left knee is in a semi flexed and externally rotated position. The right knee is in internal rotation.
	Final: The left knee is slightly externally rotated. The right knee is in internal rotation.
Gluteal muscles:	Initial: Slight atrophy of the gluteal muscles on both sides.
	Final: Slight atrophy of the gluteal muscles on the left side.

Lateral View

Table 33 Lateral postural view comparison

Position of the knee joints	Initial: The left knee is semi flexed and externally rotated while the right knee is internally rotated.
	Final: The left knee is slightly externally rotated. The right knee is in internal rotation and full extension of the knee.
Shape of the abdominal muscles	Initial: The stomach is slightly bulging out.
	Final: Optimal shape.

Anterior view

Table 34 Anterior postural view comparison

The position of the feet:	Initial: The right foot is pronated. The left foot is in light partially plantar flexion.
	Final: The right foot is pronated.
The position and shape of the toes:	Initial: The patient toes on the left foot are semi extended. Halux valgus was present on both feet.
	Final: Halux valgus was present on both feet.
Shape and position of the knee joints:	Initial: The left knee is in a semi flexed and externally rotated position. The right knee is in internal rotation.
	Final: The left knee is slightly externally rotated. The right knee is in internal rotation.
Muscle tone symmetry of the abdominal muscles:	Initial: Decreased tone of the abdominal muscles with the stomach bulging out a little.
	Final: Slight activity of the abdominal muscles without bulging.

Comparing the results of both kinesiological exams, first in the left ankle the patient used to keep in partial plantar flexion, which was influenced by the semi flexion of her left

knee. The left Achilles tendon also was appearing shorter in the initial exam and has restored its normal and symmetry by the final exam. The patient used to also keep the toes of her left foot extended which have improved and the patient no longer extends her toes. The symmetry and contour of the calf muscles has also improved. The left knee is no longer semi flexed in the final exam as it was initially. The atrophy of the gluteal muscles has improved but slight atrophy is still visible on the left side. In the initial exam the patient's stomach used to bulge out which has improved and the stomach is no longer bulging but there's still decreased activity of the abdominal muscles.

3.7.3 Assessment of stereotype of breathing

Table 35 Breathing assessment comparison

Position	Standing	Sitting	Laying
Frequency	Initial: 12	Initial: 12	Initial: 11
	Final: 12	Final: 11	Final: 11
Intensity	Initial: The breathing rhythm is more intense in both standing and sitting.		
	Final: The breathing rhythm is more intense in standing.		
Mobility of trunk, abdomen, shoulders and head	Initial: Decreased mobility of the trunk, shoulders and head during standing and sitting while their mobility increases in laying position.		
	Final: Decreased mobility of the trunk, shoulders and head during standing and while their mobility increases in sitting and laying positions.		
Breathing type	Initial: Abdominal	Initial: Abdominal	Initial: Both abdominal and lower trunk.
	Final: Abdominal	Final: Both abdominal and lower trunk.	Final: Both abdominal and lower trunk.

Initially the patient was using mainly abdominal breathing in both standing and sitting. Only when she was laying that was when she used both abdominal and lower trunk breathing. The patient after the diaphragmatic breathing exercises has improved her

breathing stereotype and after the therapy she uses both abdominal and lower trunk breathing in both sitting and laying.

3.7.4 Anthropometric measurements

Table 36 Anthropometric measurements comparison

The circumference of the thigh	15 cm above the knee cap	
	Left side	Right side
	Initial: 47 cm	Final: 41 cm
	Final: 44 cm	Final: 41 cm
	10 cm above the knee cap	
	Left side	Right side
The circumference of the knee joint	Initial: 45 cm	Initial: 40 cm
	Final: 42 cm	Final: 40 cm
	Left side	Right side
	Initial: 40 cm	Initial: 37 cm
	Final: 38 cm	Final: 37 cm
	Left side	Right side
The circumference of the calf	Initial: 34 cm	Initial: 35 cm
	Final: 34 cm	Final: 34 cm

The circumferences of the lower extremity shows a decrease in the swelling of the left. There's also a 1 cm difference in the circumference of the calf. This wasn't to a decrease in swelling but rather to the decreased hypertrophy of the gastrocnemius muscle in the right leg.

3.7.4 Gait analysis

Table 37 Gait analysis comparison

Walking rhythm	Initial: Unsymmetrical with the patient moving her right leg faster while dragging her left foot on the ground.
	Final: Unsymmetrical with the patient moving faster with her right leg.
Stride length	Initial: The stride length of the left foot is shorter.
	Final: Symmetrical length on both sides.
➤ Heel off	Initial: Optimal only on the right side while being absent on the left side.
	Final: Optimal on both sides.
➤ Toe off	Initial: Optimal only on the right side while being absent on the left side.
	Final: Optimal on both sides.
Movement and position of the knee and hip	Initial: On the the left hip the patient doesn't extend her hip while walking and rather flexion is more dominant. The left knee is also in a semi flexed position during gait.
	Final: On the the left hip flexion is greater than hip extension. The patient extends her hip slightly.
Position and movement of the pelvis	Initial: The pelvis is in a slightly anterior tilt position and dropping as well during gait to the left side.
	Final: The pelvis is in a slightly anterior tilt position without the pelvis dropping to the left side.
Movement of center of gravity	Initial: The patient is unstable and needs the support of high walker.
	Final: The patient is stable.
Stability of walking	Initial: The patient walks steadily only with the support of a high walker otherwise the patient is unstable.
	Final: The patient walks steadily with the support of French crutches.

The gait has improved after therapy and corrective gait training in several aspects. The patient no longer drags her left foot on the ground while she is walking. The stride length is also symmetrical in both sides. “Heel off” and “Toe off” phases of foot movement were missing at the time of the initial exam. At the time of the final exam the movements of the foot were present. During the swing phase of the gait initially the patient used to drop her pelvis laterally to the left side. By the time of the final exam the patient was able to maintain the position of pelvis without dropping laterally. The general stability of the patient has also improved. At the start of the therapy the patient required the support of a high walker to keep her stable. Now she only needs to use French crutches to control the weight bearing on her LE.

3.7.6 Measurement of range of motion

Table 38 Measurement of range of motion comparison

		AROM		PROM	
		Left	Right	Left	Right
Hip joint	I	S 0-0-25	S 10-0-100	S 5-0-30	S 10-0-110
	F	S 10-0-60	S 10-0-105	S 15-0-75	S 10-0-110
	I	F 15-0-CI	F 30-0-15	F 25-0-CI	F 35-0-20
	F	F 20-0-CI	F 30-0-15	F 30-0-CI	F 35-0-20
Knee joint	I	S 0-0-100	S 0-0-110	S 0-0-110	S 0-0-115
	F	S 0-0-105	S 0-0-110	S 0-0-110	S 0-0-115
Ankle joint	I	R 15-0-30	R 25-0-20	R 20-0-40	R 25-0-25
	F	R 15-0-30	R 25-0-25	R 20-0-40	R 25-0-30

Comparing the initial and final results of range of motion, the both the AROM and PROM of flexion, extension and abduction in the hip joint especially on the left hip has improved significantly. Still the patient's condition needs to improve further till the range of motion is back within its normal levels. Both the range of motion in the left knee in flexion and the right ankle in inversion have slightly improved as well.

3.7.7 Joint end feel and joint play examination

Table 39 Joint play examination comparison

Joint		Left		Right	
		End Feel	Joint Play	End Feel	Joint Play
Tibiofemoral	Initial	Firm.	Restricted into the medial direction.	Firm.	Free.
	Final	Firm.	Free.	Firm.	Free.
Patellofemoral	Initial	Firm.	Restricted into the caudal direction.	Firm.	Free.
	Final	Firm.	Free.	Firm.	Free.
Head of fibula	Initial	Firm.	Restricted into both the dorsal and ventral directions.	Soft.	Free.
	Final	Firm	Restricted into the ventral direction.	Soft.	Free.
Talocrural	Initial	Firm.	Free.	Firm.	Slight restriction into the direction of Plantar flexion.
	Final	Firm.	Free.	Firm.	Free
Subtalar	Initial	Firm.	Free.	Firm.	Restricted into the direction of inversion.
	Firm.	Free.	Firm.	Firm.	Free.

The joint mobilization according to Lewit of the tibiofemoral, patellofemoral, talocrural and subtalar joints has helped release the restrictions of the previous joint. For the head of fibula both joint play mobilization and PIR of biceps femoris was applied. The head of fibula initially was blocked in both the dorsal and ventral directions but after the therapy it's only blocked to the ventral direction only.

3.7.8 Examination of shorted muscles

Table 40 Muscle length assessment comparison

Muscle		Left	Right
Test for length of triceps surae muscle	I	Grade 2	Grade 1
	F	Grade 1	Grade 0
Test for length of hip adductor muscles	I	Grade 1	Grade 1
	F	Grade 0	Grade 1
Test for length of hamstring muscles	I	Grade 2	Grade 1
	F	Grade 1	Grade 1

For the previous muscles PIR techniques according to Lewit were applied as the muscles were also hypertonic. The therapy was able to help improve the muscles length of the previous muscles.

3.7.9 Manual muscle strength testing

Table 41 Manual muscle strength testing comparison

Muscle		Right	Left
Gluteus maximus	Initial	6	3
	Final	7	4
Iliopsoas (with emphasis on psoas major)	Initial	5	2
	Final	6	4
Hip flexors as group	Initial	6	3
	Final	6	4
Hip adductors	Initial	6	3
	Final	6	4
Gluteus minimus	Initial	6	3
	Final	7	5
Gluteus medius	Initial	6	3
	Final	7	5

Comparing the initial and final results of muscle strength tests, the therapy was effective in helping and improving the strength of the previous muscles. Still the patients

condition needs to improve further till the muscle strength is symmetrical on both sides and is back within its normal levels.

3.7.10 Palpations

Table 42 Palpations comparison

Muscle		Muscle tone		Pain – MO, MI, MB	
		Left	Right	Left	Right
Rectus abdominis	Initial	Hypotonic	Hypotonic	No pain	No pain
	Final	Normal tone	Normal tone	No pain	No pain
Iliopsoas	Initial	Hypertonic	Hypertonic	Muscle belly	Muscle belly
	Final	Hypertonic	Normal tone	Muscle belly	No pain
Gluteal maximus	Initial	Hypotonic	Hypotonic	No pain	No pain
	Final	Hypotonic	Normal tone	No pain	No pain
Abductor muscles	Initial	Hypotonic	Normal tone	Muscle belly	No pain
	Final	Normal tone	Normal tone	No pain	No pain
Adductor muscles	Initial	Hypertonic	Hypertonic	No pain	No pain
	Final	Normal tone	Normal tone	No pain	No pain
Hamstrings	Initial	Hypertonic	Normal tone	Muscle insertion	No pain
	Final	Normal tone	Normal tone	No pain	No pain
Gastrocnemius	Initial	Hypertonic	Normal tone	Muscle belly	No pain
	Final	Normal tone	Normal tone	No pain	No pain

The bridging exercise helped the patient improve the muscle tonus of the rectus abdominis, gluteus maximus and hip abductor muscles. The exercises with the over ball as well for the active exercises have improved the muscle tonus of the previous three muscles. PIR techniques according to Lewit has also helped improve the condition of the right iliopsoas, both adductor muscles, both the left hamstring and gastrocnemius and restored a normal tonus of the previous four muscles. The patient also experienced some pain during the palpation of the iliopsoas, hamstring and gastrocnemius which have also improved after the therapy as the patient didn't feel pain during palpation.

3.7.11 Fascia examination

Table 43 fasciae examination comparison

Fascia		Left	Right
Lower leg	Initial	Slight restriction in both the medial and lateral directions.	Slight restriction in the lateral direction.
	Final	Slight restriction in to the medial direction.	No restrictions in both medial and lateral directions.

Fascia release has also help the patient improve over the course of the therapy. Still the fascia on the left lower leg is slightly restricted into the medial direction.

3.7.12 Deep system stabilizers examination

The Australian school Approach

Table 44 Deep system stabilizers examination, the Australian school Approach comparison

Multifidi palpation	Initial	The patient wasn't able to contract the multifidi muscles properly in the segments L1-L5 and on the left side of the spine from the thoracic spine till the cervical spine, palpation was painful for the patient especially around the spinal segments C7-T1.
	Final	The patient wasn't able to contract the multifidi muscles properly in the segments L4-L5 and on the left side of the spine along all of the cervical spine, palpation was not painful for the patient
Transversus abdominis	Initial	Positive sign, the abdominal wall wasn't flattened.
	Final	Negative sign, the abdominal wall were flattened.

Prof. Kolář Approach

Table 45 Deep system stabilizers examination, Prof. Kolář Approach comparison

Trunk diaphragm test	Initial	Positive sign, the diaphragm activity wasn't clearly visible during aspection and the patient couldn't activate the diaphragm against pressure. No other signs disturbances.
	Final	Negative sign, the diaphragm activity was visible during aspection and the patient was able to activate the diaphragm against pressure. No other signs disturbances.

Prior to therapy the patient showed that she had problems with her deep stabilizing system and also problems activating the multifidi, transverse abdominis and the diaphragm. Improper activation of the diaphragm was also shown in the stereotype of breathing where the patient used mainly abdominal breathing in general. The diaphragmatic breathing and also the bridging exercise helped the patient improve her control over previous muscle.

3.7.13 Examination of dermatomes of both lower extremities

Table 46 Sensation of the lower extremity comparison

Dermatome	Initial	Final
Dermatome of L4 segment	Decreased tactile sensation especially around the hip joint.	Normal sensation
Dermatome of L5 segment	Decreased tactile sensation especially around the hip joint.	Slight decrease in sensation

Prior to therapy the patient had issues recognizing touch near the superficial area around her scar. After the therapy the area where the patient wasn't able to recognize touch increased significantly. Still if you are circa 1-2 cm from the scar the patient starts to lose the sense of touch. This is mainly due to the fact STT techniques were not applied on that area as the stitches were still attached and time was required to let the scar heal first.

Overall, the diaphragmatic breathing exercise was helpful to improve the patient's breathing pattern and also achieve better control and activation of her abdominal muscles to improve her global stability. PIR and joint mobilization techniques according to the principles of Lewit has helped the patient improve her condition and prevent kinesiological changes that occur. STT techniques with the soft massage was helpful for the patient to restore sensitivity on the effected tissue.

4 Conclusion of case study

The ultimate physiotherapeutic goals generally after partial hip replacement is to help provide pain relief, improve the strength around the hip joint, prevent musculoskeletal changes, and improve gait and the reintegration of the patient into activities of daily living. But what needs to be also taken into consideration are the specific requirements that the patient needs to be fully rehabilitated properly as every patient requires an individual therapeutic approach.

For the patient in this study there were specific points to be taken into consideration aside from the common therapy approach such as the exercises created for the patient should have an overall positive effect on the global stability of the patient to help prevent future fall injuries. Other points that were important in this study was the patient's history with vein varicose and also the fact that she atrioventricular block type 2 and pacemaker that requires some attention to ensure the patient's safety.

Almost all of the short term therapy plans were meet at the end of the study. I have also benefited a lot from my two week visit into the orthopedic surgery department and had the opportunity to see various orthopedic patient's after various surgeries.

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6 Supplements:

6.1 Photos:



Photo 3: pre preoperative X-ray imaging of the left hip and thigh from Anterior-Posterior view taken on the 10th of January 2019.



Photo 4: pre preoperative X-ray imaging of the left hip and thigh from Anterior-Posterior view taken on the 10th of January 2019.



Photo 5 shows the left hip joint from Anterior-Posterior view taken on the 11th of January 2019 after the surgery was already performed on the patient.

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6.3 Application for Approval by UK FTVS Ethics committee

CHARLES UNIVERSITY
FACULTY OF PHYSICAL EDUCATION AND SPORT
Josef Martího 31, 162 52 Prague 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: Case study of a patient with a partial hip replacement after a fractured proximal femur.

Project form: Bachelor thesis

Period of realization of the project: January 2019

Applicant: Abdullaziz Abdulmalik, UK FTVS – Physiotherapy department

Main researcher: Abdullaziz Abdulmalik, UK FTVS – Physiotherapy department

Workplace: Ústřední vojenská nemocnice

Supervisor: Mgr. Kateřina Maršáková

Project description: Case study of physiotherapy treatment of a patient after partial hip replacement surgery. The aim of the study is to apply physiotherapy procedures and to observe and evaluate the results of the rehabilitation therapy used. The methods that are used in the research are based on the knowledge which was obtained during the three years of bachelor study of the physiotherapy program at UK FTVS.

Characteristics of participants in the research: One female participant aged 85. Diagnosed with an unspecified fracture of the proximal femur.

Ensuring safety within the research: Non-invasive methods are used. The research is taking place in the orthopedic surgery department of the military hospital in Prague. All precautions and risk prevention are followed according to the specific hospital rules, policies and signed documentation. All of the rehabilitation regimes are designed, prescribed and implemented procedures including assessments, therapy, discussions and any kind of communication between patient and researcher are in the presence of the responsible supervision of Bc. Martin Lassner. Risks of therapy and methods will not be higher than the commonly anticipated risks for this type of therapy.

Ethical aspects of the research: Processing and retaining the data in an anonymized form will ensure personal data protection. The data will be used only in the bachelor thesis and will not be published anywhere else. After the anonymization the personal data will be deleted. Photographs of the participant will be anonymized by blurring the face, parts of the body or any characteristics that could lead to identification of the person. Any non-anonymized photographs will be deleted after the end of the research.

I shall ensure to the maximum extent possible that the research data will not be misused.

Informed Consent: Attached.

It is the 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, 17 of January 2019

Applicant's signature: 

Approval of UK FTVS Ethics Committee

The Committee: Chair: doc. PhDr. Irena Parry Martinková, Ph.D.
Members: prof. PhDr. Pavel Slepíčka, DrSc.
doc. MUDr. Jan Heller, CSc.
PhDr. Pavel Hráský, Ph.D.
Mgr. Eva Prokešová, Ph.D.
MUDr. Simona Majorová

The research project was approved by UK FTVS Ethics Committee under the registration number: 035/2019

Date of approval: 17.1.2019

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.

UNIVERZITA KARLOVA
Fakulta tělesné výchovy a sportu
Josef Martího 31, 162 52, Praha 6
Stamp of UK FTVS


Signature of the Chair of
UK FTVS Ethics Committee

6.4 Patient Consent Form

UNIVERZITA KARLOVA
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 na, 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 názvem

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 poučení..... 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 zástupce

Vztah zákonného zástupce k pacientovi Podpis: