

**Case study of physiotherapy treatment of a patient after a pertrochanteric fracture of
the proximal right femur**

Bachelor thesis

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Declaration

I hereby declare that this case study was completely done by myself, and it is based on my clinical work at the Thomayerova hospital in Prague from the 9th of January 2023 until the 3rd of February 2023.

Furthermore, I state that all the information, examinations, therapeutic techniques, and clinical knowledge which is illustrated in this bachelor thesis are based on my experience which I have gained from lectures and practices at the hospitals throughout my study years at faculty of physical education and sport of Charles university.

I further declare that all health and safety protocols were followed. And all techniques which were applied in this case study were not invasive.

Prague, July 2023

Asem Mohammed

Acknowledgement

I would like to offer special thanks to my whole family for their huge support throughout my years of study. I would also like to thank my supervisor Mgr. Kateřina Maršáková for her guidance and support during my bachelor thesis work.

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Abstract

Title: A case-study of physiotherapy treatment of a patient after a pertrochanteric fracture of the proximal right femur.

Thesis aim: This thesis aimed to evaluate the impact of physiotherapy approach provided to a patient who was diagnosed with a pertrochanteric fracture of the proximal right femur. The theoretical knowledge of the anatomical, etiological, and kinesiological basis of the pertrochanteric fracture, with further discussing the related physiotherapeutic approaches will be noted in the first part of the current thesis. Moreover, a second part will handle the practical physiotherapeutic approach to a patient who suffered from proximal right femur pertrochanteric fracture.

Clinical findings: This case study is evaluating the condition of a 74-year-old patient who underwent an osteosynthesis surgical procedure after experiencing a per trochanteric fracture of proximal right femur. The assessment took place 7 days post-surgery and illustrated a significant limitation of ROM on the operated side along with several musculoskeletal defects.

Methods: All methods and procedures mentioned in the current thesis were in adherence to the literature suggested by Charles University in Prague, Faculty of Physical Education and Sports.

Results: After 11 sessions of physical therapy there was a noticeable improvement in the patient's physical state

Conclusion: There was positive impact of the physiotherapeutic approach done to the patient.

Keywords: hip joint, right femur, injury, rehabilitation.

Abstrakt

Název: Kazuistika fyzioterapeutické péče o pacienta s diagnózou pertrochanterická fraktura proximálního femuru vpravo.

Cílem práce: Tato práce si kladla za cíl zhodnotit dopad fyzioterapeutického přístupu u pacienta, u kterého byla diagnostikována pertrochanterická zlomenina proximálního pravého femuru. V první části této práce budou uvedeny teoretické poznatky o anatomických, etiologických a kineziologických základech pertrochanterické zlomeniny s další diskuzí souvisejících fyzioterapeutických přístupů. Druhá část se navíc bude zabývat praktickým fyzioterapeutickým přístupem k pacientovi s pertrochanterickou zlomeninou proximálního pravého femuru.

Klinické nálezy: Tato kazuistika hodnotí stav 74leté pacientky, která podstoupila chirurgický zákrok na osteosyntéze poté, co prodělala per trochanterickou zlomeninu proximálního pravého femuru. Hodnocení proběhlo 7 dní po operaci a ukázalo významné omezení ROM na operované straně spolu s několika muskuloskeletálními defekty.

Metodika: Všechny metody a postupy uvedené v této práci byly v souladu s literaturou navrženou Univerzitou Karlovou v Praze, Fakultou tělesné výchovy a sportu.

Výsledek: Po 11 sezeních fyzikální terapie bylo patrné zlepšení fyzického stavu pacienta.

Závěr: Fyzioterapeutický přístup k pacientovi měl pozitivní dopad.

Klíčová slova: kyčelní kloub, pravá stehenní kost, úraz, rehabilitace.

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1. Introduction

This thesis aims to provide a comprehensive theoretical basis and illustrates the practical physiotherapeutic approach to a patient suffering from an injury that caused a pertrochanteric fracture of the proximal right femur and treated with dynamic hip screw as a surgical fixation.

The general part, part one, of the current thesis, is to provide a comprehensive appraisal of the theoretical basis of the anatomical, etiological, and kinesiological aspect of fracture pertrochanteric. And notably, discussing the potential role of physiotherapeutic approach that can be applied on patients diagnosed with hip fractures.

The special part, part two, of the current thesis provides some shedding light on the physiotherapy treatment of patient after pertrochanteric fracture of the proximal right femur.

The practical part in this thesis analyzes all the procedures, examinations results, performance output of the patient, and finally gives a comparison between the initial examinations and the final ones, so that we can assess the outcomes and impact of the physiotherapy that was performed.

This bachelor thesis is adherent to clinical work at Fakultní Thomayerova nemocnice (FTN).

2. General part

2.1 Characteristics of fractures of the hip joint

The hip joint categorized as a ball and socket synovial joint, the head of the femur is the ball, and the acetabulum of pelvis represents the socket, in which this articulation connects the pelvic girdle with the lower limb. The hip joint can be considered as a multi-axial joint type due to the complex anatomical structures, and thus gives a wide range of movement on more than one axis. Also, hip joint is further designed for lower limb stability [33].

Fractures of the proximal femur (PFFs) are more common in older patients and often represents a life-changing event. Within only 1 year of a hip fracture, less than half of the patients regain their mobility of pre-fracture level and the ability of perform other normal daily activity [42].

The majority of hip fractures are due to falls or accidents in the elderly, and there are some risk factors that play a key role in these types of fractures. The most predominant risk factor is osteoporosis; however, other risk factors may include previous history of falls, gait abnormalities, vertigo, other neurological diseases as Parkinson disease. Moreover, many patients have multiple risk factors, but the key role here is the age-associated bone density, in which old age have low bone density in comparison to other age subgroups [42].

The annual incidence of femur fractures is increasing steadily with estimated numbers of 6.3 to 8.2 million cases in 2050; while the incidence of femoral fractures at the neck femur is approximately equal to pre-trochanteric fractures consisting of 90% of all femur fractures; the remaining 10% of the fractures represent sub-trochanteric fractures [3,8].

The clinical examination of such fractures can be divided into two major concerns; the first concern is the common symptoms associated with these types of fractures which are severe pain in the hip, loss of ability to put weight on the injured side, loss of ability to move or stand up, bruising and inflammation around the hip, stiffness and pain of the injured leg, and un-natural position [32,11].

The other concern is the evaluation of these fractures using plain radiographs, an antero-posterior view of the pelvis can be obtained along with a lateral view of the affected side. It

is also important to define exactly the fracture pattern on the radiographs as it will dictate the surgical approaches suitable for these fractures [32].

Intra-capsular hip fractures can be classified using the Pauwel system which divides these fractures based on the angle of the fracture into three groups; type 1) <30 degree; type 2) 31-50 degree; and type 3) >50 degree. Another classification system and is more recognized is the Garden system which describes the fracture pattern according to the completeness and displacement of the fracture into four groups: type 1) incomplete fracture and no displacement; type 2) complete fracture and no displacement; type 3) complete fracture and partial displacement; and type 4) complete fracture and complete displacement [32].

On the other hand, extra-capsular fractures can be divided into trochanteric and sub-trochanteric fractures in which the trochanteric fractures occur between the greater and lesser trochanter named as Evan's classification, while the sub-trochanteric fractures occur between the lesser and 5cm distal to the lesser trochanter [25].

2.1.1 Biomechanics of the hip joint

Biomechanics of the hip joint is simply the physics of motion produced by the hip during walking, standing, or other related positions. It is very important to understand how hip bones, hip ligaments, hip muscles co-ordinate with each other to transfer the body weight from the axial skeleton to the lower limb [40].

Understanding the biomechanics of the hip is vital in the advances of diagnosis of many pathological conditions related to hip fractures. The evaluation of the function of the hip, and the development of many therapeutic approaches for the management of hip joint problems mainly by understanding the hip biomechanics [40,9].

2.1.2 Static model of hip biomechanics

In the hip biomechanics of the static model, the prime muscle to generate 2-times the body weight's force is the gluteus medius, which maintains body balance and prevent it from leaning to the un-supported side of the body. Gluteus medius muscle, in static model,

provides resistance to the loads exerted applied to the femur and translates these loads into tensile bands on the femur lateral side below the insertion of gluteus medius. This occurs in the single-leg stance, as shown in Figure 1 [18,41].

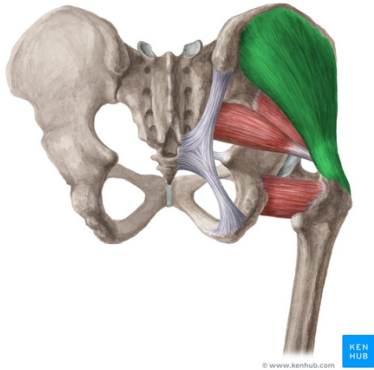


Figure 1: gluteus medius (highlighted in green) [18].

A various of changes occur during single-leg stance as follows: the gravity center moves away and distally from the supporting leg, an increase in the body mass via the non-supporting leg, the abductor muscles as the superficial fibers of gluteus maximus, the tensor fascia latae, both gluteus medius and minimus, the piriform and obturator internus, offset the resisting muscles of the femoral head in which this creates balance around the femoral head center [12,20].

During bilateral-leg stance, the gravity center is located between the two hips, with an equal force. Also, the body weight has an equal force with both legs, as the gravity affects, in a vertical direction, the lower extremities [12,20].

Bone tissue could be affected during this stance include the development of either a hypertrophic bone alteration or an atrophic bone status in cortical bone or cancellous bone [23].

In this case, the joint stability in the lower limbs mainly depends on as follow: the stability in hip, knee and ankle joints named as articular geometry, and also stability of dynamic elements as muscles, tendon and fascia, and static elements as ligaments. The dynamic structures adjust their length, while the ligament, as static structures, will be taut in extension on one side and flexed in the other side, as shown in Figure 2 [20].

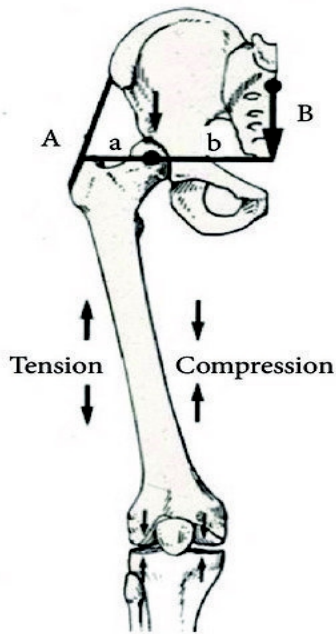


Figure 2: The Koch model of hip biomechanics [20].

2.1.3 Joint Forces at the Hip

In order to keep a balanced pelvis, the body weight and the abductor tension should be balanced; this results in the forces applied to the hip joint, which named as joint forces at the hip. Many factors contribute to the joint forces at the hip, including the abductor lever arm which is attached to the neck of the femur shaft, and the body-weight lever arm. Any increase in the abductor lever arm, it will lead to decrease in the force required to maintain the horizontal pelvis, as shown in Figure 3 [20].

The highest stress on the hip joint can occur during walking or descending the stairs, the average loads on the hip joint were as follows: about 4 km/h in walking which equals 238% of body weight, 108% to 260% body weight in descending the stairs, while 251% body weight in ascending, 40% body weight during chair rise, about 32% body weight in standing, and from 230% to 290% during single-leg stance [20].

Development of bone density diseases as osteoporosis, can be detected when these measures changes [18].

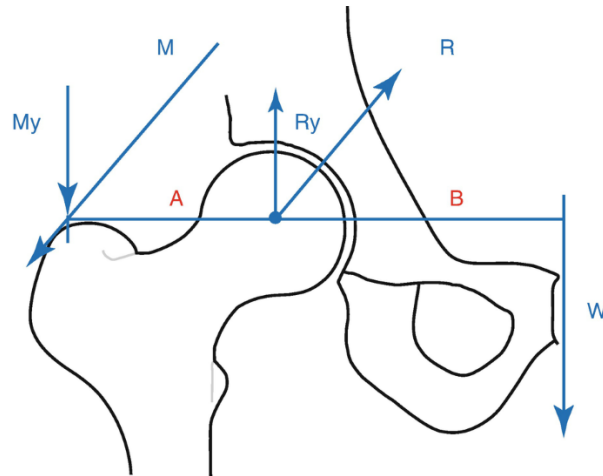


Figure 3: Biomechanics of the hip joint [20].

2.1.4 Dynamic Model of Hip Biomechanics

It is obvious to characterize the hip joint as being more stable than the knee joint, but less than the ankle joint as it is seen during the sagittal plane. As in this plane, the geometry of the hip joint shows no resistance against the force of varus deforming which takes place in the midstance phase of the gait. Depending on this fact, the hip should depend on a dynamic stabilizer as gluteus medius and a static stabilizer in order to preserve the equilibrium during midstance phase of gait [14].

It was demonstrated that iliotibial band (ITB) is the static stabilizer along with gluteus medius during the midstance phase of gait suggesting that ITB should be included in the biomechanics of the hip joint to provide more a comprehensive, dynamic, and complete model of hip stability [14].

The ITB serves as a solution of many paradoxes of the gait cycle; for example, during the midstance phase, the gluteus medius is less active. It was found that ITB plays as a tension band during this phase of gait [14].

2.1.9 Clinical Prevalence

In order to manage the hip pain, a reduction of the joint reaction force should be decreased through the following: reduction in body mass, an increase in the abductor force,

limping and using a cane in the opposite side; as it allows bringing the gravity center closer to the femoral head center [10, 16].

When ascending stairs, patients with bone density problems experienced a limited range of motion in all three planes, and lower hip peak external rotation. On the other hand, when descending stairs, these patients experienced an increase in the ipsilateral trunk lean, reduction in the sagittal plane motion, lower the moment of peak extension and rotation, higher hip adduction and abduction moments, and a higher internal rotation moment [10, 16].

Patients with amputation above knee demonstrated, despite having intact hip abductors, a positive Trendelenburg gait pattern. Moreover, the gluteus muscle is not able to provide adequate hip stability during gait as to ITB action loss [16].

2.2 Kinesiology of the hip joint

2.2.1 Hip flexion

Hip flexion occurs when the thigh moves in the direction of the trunk anteriorly, moreover, the activity of the muscle along with the range of motion varying according to the position of the knee or the movement is either unilaterally or bilaterally. Iliopsoas muscle is the prime performer of flexion of the hip [17].

2.2.2 Hip extension

Hip extension is performed when the thigh moves posteriorly, unlike to the hip flexion which is mainly caused by the anatomical structure of the hip; the range of motion (ROM) is significantly less in hip extension. As the flexion movement, the extension of ROM is affected by the knee joint position. Gluteus muscle is the prime performer of hip extension [17].

2.2.3 Hip abduction

When the distal part of the thigh moves laterally away from the midline, the hip is abducted. The direction of the movement is about the sagittal axis. Gluteus medius and minimus are the prime performer of the hip abduction. Although tensor fasciae latae is a hip abductor, its function mainly as a stabilizer [17,28].

2.2.4 Hip adduction

When the thigh moves towards the midline in a medial direction, the hip is adducted. The adduction of the hip comes in two parts; the first part is the hip adduction with the flexion of knee; and the second part is the adduction of hip with the extension of knee. The first part causes a higher participation of one joint adductors of the hip, and the second part causes more activation of the two joint adductors of the hip [17,28].

2.2.5 Hip internal rotation

Internal rotation of the hip is also referred to medial rotation of the hip, and the movement of the rotation takes place in the transverse plane around the vertical axis. The ROM is about 45 degrees at the time of internal rotation of the hip [28].

2.2.6 Hip external rotation

External rotation, named as lateral rotation, takes place when the anterior group of thigh muscles rotates laterally. The range of motion is 45 degrees during the external rotation of the hip which is a physiological model [28].

2.2.7 Hip circumduction

Circumduction of the hip means a circular movement as flexion, abduction, extension, and adduction which represents the angular movement of the femur. The above-mentioned planes are incorporated into the hip circumduction. Flexion and extension take place in the sagittal plane, the adduction-abduction in the frontal plane, while the rotations in the transverse plane [17,28].

2.3 Fractures of the hip joint in the elderly: causes and prevention

Hip fractures, one of the most common fractures, can be a result of direct trauma to the hip joint, or a high-velocity accident to the lower segments which transferred to the hip joint, causing the severe fracture of the hip [10, 16].

The increase in fracture hip risk factors in older age patients are consistent with the increased hip fractures across these age groups. However, hip fractures in the elder age groups caused mainly by falls and accidents; but there are some risk factors. The risk factors associated with increased hip fractures in elder ages are mainly decrease in muscle density and strength, decrease in the muscles mobility, reduction in bone intensity, higher body mass index (BMI) and obesity, or acute blood pressure diseases [30].

Moreover, some potential approaches to treat such cases are mainly depends on targeting nutritional and hormonal imbalance which are the main causes of hip fractures such as bone loss of estrogen dependent, deficiency in vitamin D and calcium, etc [31].

Notably, there are other approaches that target falls and accident hip fractures prevention such as muscle strengthening, balance muscle training, modulation of environmental factors that contribute to these fractures as low lighting, lack of safety handles, low friction floor and so on. [31].

2.3.1 Muscle mass

The decrease in muscle mass is associated with increased risk of hip fractures in the elderly. As the amount of muscle mass decreases, the muscle strength decreases and subsequently increase fractures [42,31].

The decrease in muscle mass could be attributed to the lack of muscle training or exercise that individuals should perform, along with a notably decrease in the anabolic hormones as human growth hormone (hGH), testosterone, and estrogen; these hormones are responsible for bone tissue sustainability [42].

Sarcopenia, a term defined as a progressive muscle mass loss and strength, which is further associated with higher risk of hip fractures and falls, especially in the elderly [42].

As hip fractures are associated with increased mortality, physical morbidity, and reduction in the overall activity; there is a bad need of the resistance training of the muscles, as this training is associated with increase in the proprioceptive function, more stabilization, and balance [31].

Individuals with high muscle mass in the hip region are unlikely to have a fracture hip, or the probability and incidence of hip fractures will be reduced as muscles of the hip region characterized by the “cushion” reflex that able the muscles to absorb some pressure caused by the fall [31].

2.3.2 Bone density

Elder people are most likely to have both decrease in muscle mass and bone density. One of the most hormones that play a key role in bone density in females is the estrogen, which is responsible for bone tissue preservation, moreover, females after menopause are at a higher risk of having hip fractures [38].

Certain changes in lifestyles can help people preserve their bone density and reduce the incidence of catching osteoporosis or other related bone diseases. One of these factors is regular exercise which is essential; as adults who aged 18 to 64 should do 2h and half of moderate exercise training every day, such as walking or cycling. Resistance training and weight-bearing exercise are very important to increase the bone density and prevent easy

fractures. On the other hand, patients with bone density diseases as osteoporosis, shall no perform any intense sports [38,37].

Minimizing the catabolic factors that may cause bone fracture, can be a possible approach to reduce the risk factors associated with bone fracture as a result of bone density diseases. Also, older ages of females and males via low estrogen levels in case of females, or low testosterone level in case of males contributes to bone fractures as decrease in these hormones results in decrease in hGH secretion, and decrease micronutrients absorption that are very essential for bone density as vitamin D and calcium [31].

2.4 Hip pertrochanteric fractures

Pertrochanteric fracture of the hip joint is characterized by an extra-capsular fracture of the hip joint, varying from greater trochanter or lesser trochanter depending on the nature of the damage [25].

2.4.1 Classification of pertrochanteric fractures

The Orthopedic Trauma Association (OTA/AO) classification system is mainly depending on the fracture area and morphology of the fracture, in which the system uses numbers to identify bones according to bone structures, and alphabetical letters to figure out the nature and fracture severity, and the location of the fracture as well, as shown in Figure 4 [3].

The OTA/AO is used widely by many professional doctors as the most decisive and detailed method of describing bone fractures.

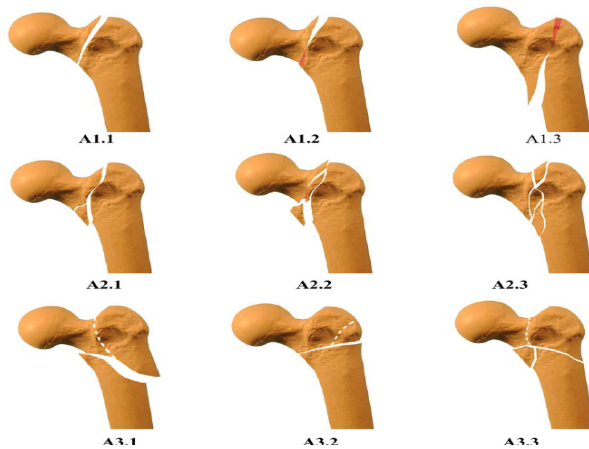


Figure 4: The OTA/AO classification system of pertrochanteric fractures [3].

2.5 Pertrochanteric fracture of the hip: surgical approaches

The appropriate surgical procedure ranging from a simple procedure in which the orthopedic doctor aims to achieve an appropriate amount of stability via applying a surgical method to mimic the anatomical movement of the hip joint in order to restore as much of the physiological ROM as possible [30].

However, it is not an easy surgical choice to perform, as most of the patients are elder. Old age is associated with other co-morbidities as hypertension, diabetes mellitus, bone density diseases as osteoporosis, sarcopenia or other health conditions that may interfere with the success rate of the surgical procedure. Though, the orthopedic surgeon should assess the medical history of the patients, and fracture condition and type as well [30,28].

2.5.1 Dynamic hip screws (DHS)

The nature of the pertrochanteric fracture along with the medial status of the patient determines the surgery choice made by orthopedic surgeon. One of the most consistent approaches is implanting dynamic hip screws or named, in other terms, sliding hip screws [43].

The implantation of DHS is done in an oblique fashion into the femoral head via the lateral aspect of the femur and is fixed using a plate which is fixed in the lateral aspect of the

femoral shaft. DHS is mainly used in stable pertrochanteric fractures, as shown in Figure 5 [43].

On the other hand, it is less beneficial in the type of unstable fractures as they have a limited ability to stabilize fracture collapse of the femoral shaft [43].

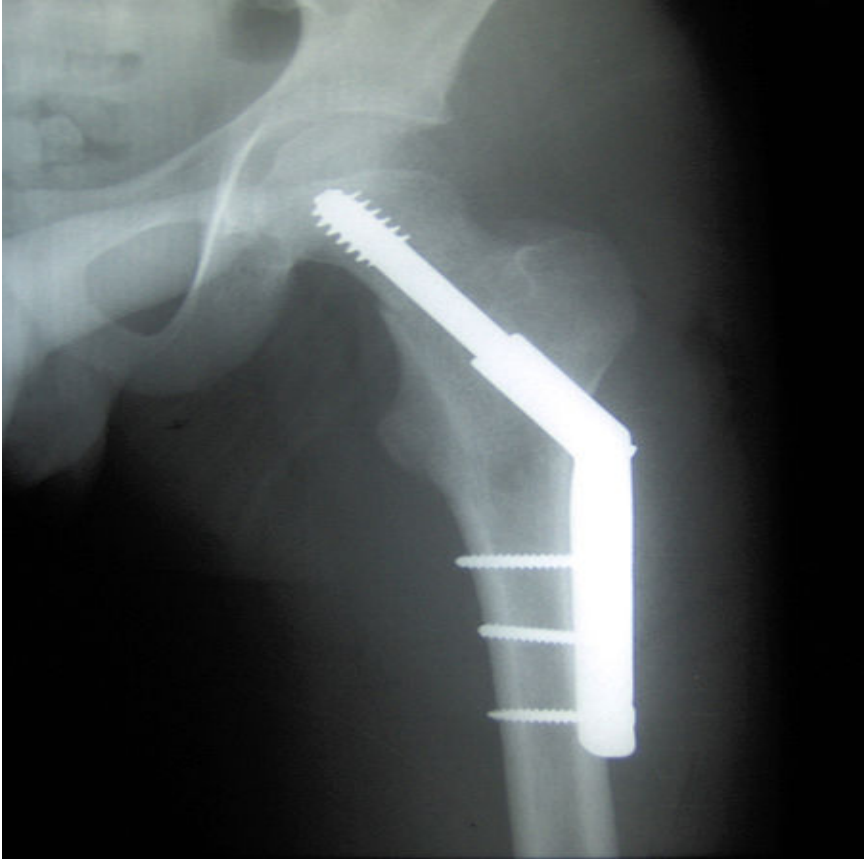


Figure 5: DHS [43].

2.5.2 Gamma Nails

When there is a fracture in the proximal femur, the best method for the management of this fracture is the gamma nails, as it has the benefits and features of the DHS and the nail fixation. The nail fixation is performed via inserting a nail in the intramedullary part of the medulla cavity to achieve a higher stability [8].

The gamma nails, when done appropriately, there is a more stability achievement in a shorter time of period compared to other methods, so post-operative complications are

unlikely to occur such as sarcopenia, deep vein thrombosis, leg ulcers, etc., as shown in Figure 6[8].



Figure 6: Gamma Nails [8].

2.5.3 Hip replacement

When there is an unstable hip fracture and the medical condition of the patient is not good, the other methods of surgical fixation will likely to have lower success rates. The method of hip replacement is incorporated in most cases, as shown in Figure 7 [43].

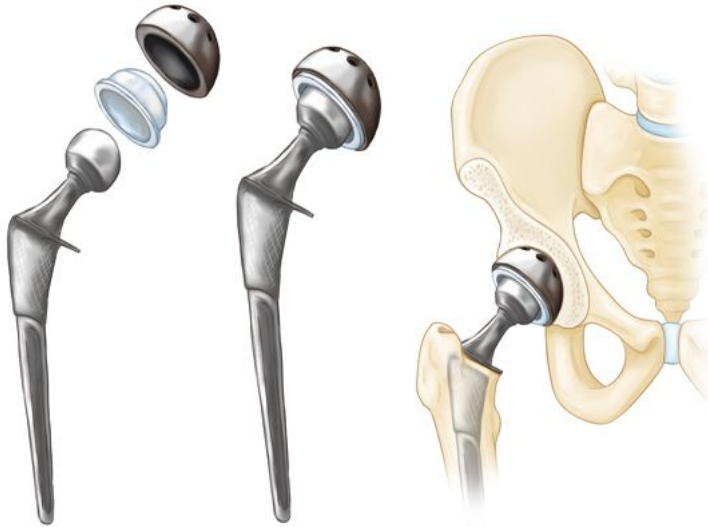


Figure 7: Total hip replacement [43].

2.6 Classifications of femur fractures and the corresponding surgical approaches.

Femur fracture is caused mainly by high-impact trauma, as the femur is a strong bone and needs large amount of force to be broken, so it is common in car accidents, or motor vehicle collisions. The site of the fracture characterizes the severity of the fracture, for example, fracture of the diaphysis or middle of the femur are different in severity from fractures of the head, neck, of trochanter; however, fractures of the head, neck, or trochanter are called hip fractures and are managed differently from diaphysis fracture of middle fracture [6,17].

Fractures of the femur are classified depending on the location of the fracture, the pattern of the fracture, the association of other structures like skin and muscle. The femur shaft is divided into three important parts as distal, middle, and proximal.

The common types of femur fractures are:

- Transverse fractures: the break of the shaft is a straight horizontal line across the shaft.

- Oblique fractures: the break has an angles line across the shaft.
- Spiral fractures: the break line encircle the shaft.
- Comminuted fractures: the break is severe; and the bone is broken into three or more pieces which corresponding to the amount of force needed to break the bone.
- Open fracture: the bone breaks out into the skin or the wound penetrates down to the broken bone. This type of fracture can be open or compound, the open takes more time to heal, and more associated with complications. [36,42]

2.6.1 Surgical treatment

The surgical treatment of the femur fractures is mostly fixed within the first 24-48 hours of fracture which termed as timing of the surgery. However, in some cases, the fixation is delayed due to an existence of life-threatening conditions or unstable medical conditions [30].

In case of open fractures, antibiotics should be administrated as soon as the patient is arrived at the hospital, to reduce the risk of infection and complications. The other structures should be cleaned during surgery. Sometimes, the doctor place the patient either in a long-leg splint or in traction, if the time between initial care and surgery is long, to keep the fractured bones as aligned as possible [30,43].

External fixation: in this type of fixation, metal pins and screws are placed into the broken bone above and below the fracture site and attached to a bar outside the skin; this way holds the bone in a proper position. However, external fixation is a temporary treatment as they are easily applied and often placed in case of multiple fractures, as shown in Figure 8 [30,43].

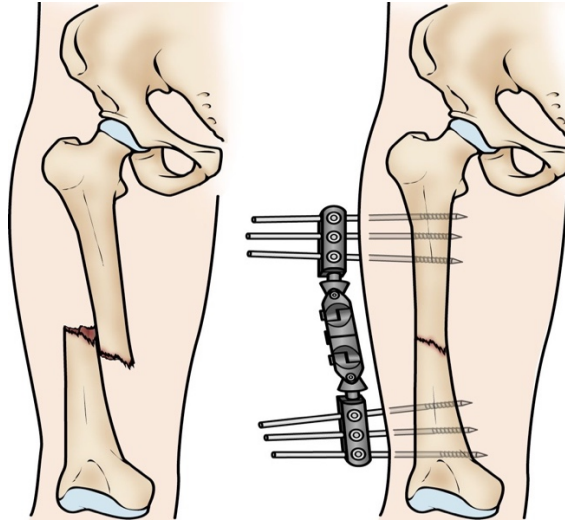


Figure 8: External fixation by screws and pins [43].

- **Intramedullary nailing:** This method is widely used nowadays for treating femoral shaft fracture. During this procedure, a designed metal rod is inserted into the shaft of the femur to stabilize the fracture, as shown in Figure 9[43].

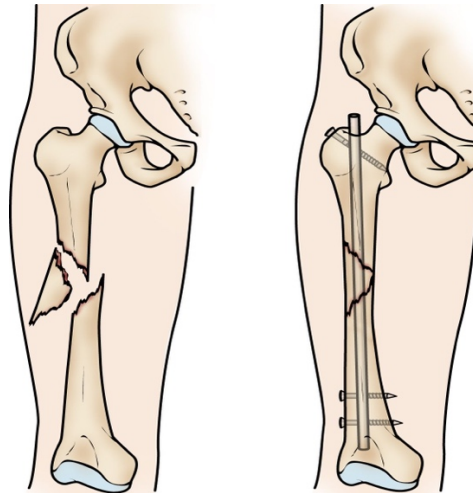


Figure 9: Intramedullary nailing [43].

- **Plates and screws:** during this procedure, the bone pieces are regrouped into their normal alignment using screws and metal plates attached to the outer surface of the broken bone. They are often used, when intra-medullary nailing is not possible as fractures that extend to the knee or the hip. [43].

2.6.2 Prevention methods

Preventing fractures is more desirable than treating them. In this context, good preventive measures are necessary in the old age. At old age, the bone density becomes lower which may double or even triple the risk of fractures; that a major concern as people with old age experiencing low bone density; moreover, bone density tests at these ages are so recommended [31,37].

Most fractures occur due to falls, so exercises that maintain the muscle strength and preserve the bone density are recommended. Good exercises also improve the balance of the body and the co-ordination, these exercises can be climbing the stairs, hiking, jogging dancing, swimming, and weight training [31,37].

Another preventive method is healthy food, supplements as calcium and vitamin D are so recommended in old age, but also food rich in potassium as fruits and vegetables daily which also helps in maintaining the muscle mass [31,37].

On the other hand, there are numerous preventive methods for secondary fracture prevention and these prevention methods focus on pharmacological and non-pharmacological therapy. The pharmacological preventive method is based on precisising anti-osteoporotic medications drugs with different mechanism of actions; these drugs can be classified as anti-absorbable, anabolic, hormonal replacement therapy, selective estrogen inhibitors, and monoclonal antibodies.[31].

Anti-absorbable drugs as bisphosphonate focus electively on bone surfaces remodeling and blocking the action of osteoclasts activity, while the anabolic drugs as Teriparatide stimulates bone formation and increase bone minerals.[31].

The non-pharmacological preventive method is based on risk modification of the patients as obesity-risk modification, avoiding high-speed driving, stop smoking, avoiding excessive alcohol intake, maintain a balanced nutrition, or regular wearing of hip protectors. [31].

2.7 Physiotherapeutic approach

The surgical approach for hip injuries is mostly common across older populations, and it is mainly depending on the degree of fracture severity and the nature of the injury. Post-fracture rehabilitation care consists of multi-disciplinary approaches, as the goal is to reduce the time of recovery, the incidence of morbidities, or the financial costs. Moreover, it is important to make a rehabilitation plan as to improve the daily living activities and maintaining the flexibility, strength and balance of the body [24].

The patients' assessment is important to design a physiotherapeutic approach to a post-hip fracture, moreover, the assessment depends on the method of fixation, internal or external, degree of fracture severity and other medical conditions related that could affect the outcomes of the approaches as Diabetes Mellitus (DM), Hypertension (HTN), and other bone density diseases as osteoporosis or sarcopenia [24].

While surgery aims to restore the mobility of the joint and commence early mobilization, regular intensive physiotherapeutic approach is needed to aid in the rapid progression of joint mobility, which in turn aims to restore the pre-morbid mobility status of the patients', however, many patients do not regain the full joint mobility even with rehabilitation plans, so they need special social care input [1].

The program of rehabilitation plan begins promptly where the following are adhered to;

a) two to three days post-operative: where we follow some instructions for prevent post-operative pneumonia and atelectasis, prepare the patient for active program of exercise, and also to begin transfer and start gait training process. These instructions are: instruct patient in deep breathing, initiating iso-metrics and ankle pumps along with extremities, and initiating bedside sitting [33].

b) three to five days post-operative: where we are performing the following training: progressive gait training sessions and observing weight-bearing precautions, and further progress to walk; all of which aim to establish an independent gait using a proper gait pattern. We also initiate training in activities in daily living which includes bed mobility and from bed-to-toilet movements; all of which aim to achieving independence with all transfers. After that, we initiate active range of movements and starting a strengthening program according to each patient's needs with respecting to the following:

Supine: hip adduction and abduction, gluteal and quadriceps sets, leg raise, hip and knee

flexion, internal and external rotations, and short arc quadriceps.

Sitting: long arc quadriceps, hip flexion, and ankle pumps [33].

All these exercises aim to an increase in the strength of involved extremities along with an increase in the independence and exercise programs [33].

Moreover, when we initiate internal fixation, partial weight-bearing is recommended for a period of 8-10 weeks depends of the imaging evaluation of the healing of fractures, and after 3 months, full weight-bearing can be allowed. Patients, also, are recommended to undergo balance and proprioceptive rehabilitation programs, as these abilities are quickly lost due to inactivity. Rehabilitation plans for balance and falls prevention are also recommended [21].

The components of the rehabilitation plan include: hip extension, heel raises onto toes, double arms lifting, standing diagonal reach, modified get up and go, overhead arm extension, repeated chair stands, vest and manual exercises, stepping up and down, and lastly calf raises either with both legs or with one leg [21].

The importance of rehabilitation plan and home exercises programs is moderate to large improvement in physical performance and quality of life, also an improvement of gait, lower limb mobility and strength [25].

2.7.1 Therapeutic procedures after pertrochanteric fracture of the proximal femur.

Patients after pertrochanteric fracture of the proximal femur, will follow up with postoperative rehabilitation plan. Postoperative physiotherapy plan is well structured to improve gait, balance, range of motion, muscle strength and mobility and to reduce risk of fractures again. Firstly, right after the surgery, early mobilization is crucial for obtaining optimal postoperative management results. Early mobilization consists of sit to stand, getting in and out of bed and walking with an assistive device. Early assisted walking enhances functional recovery [26].

Also, to improve the range of motion of the affected hip joint during the first phase of the postoperative plan which includes active, active assistive and passive movement is seen to help increase the range of motion and its strongly recommended that during acute care

phase after surgery. Patient will perform active movement of ankle in the direction dorsiflexion and plantarflexion [36].

Also, daily stretching is also found to improve range of motion and promote joint function after surgery [39].

Next, to improve lower limb function, strengthening exercises significantly helps to improve the strength of hip movements and regain active range of motion of hip joint and the strengthening exercises mainly focus on the muscles of the lower extremity of the affected limb [4].

Furthermore, there are different types of physical therapy modalities which can be used like cryotherapy to reduce inflammation [27].

Another study shows that transcutaneous electrical nerve stimulation (TENS) which may be used to reduce acute postoperative pain after hip fracture surgery, has a great pain reduction, this method was found to be an effective analgesic modality for intense pain following hip fracture which resulted in greater and more rapid pain reduction, greater range of hip flexion [41].

One more study shows that low power laser therapy is beneficial after fractures as it helps improve bone healing and promotes fracture healing and osteogenic differentiation of stem cells [5].

A study speaks about the benefits of Pilates exercises after hip surgery and shows how this form of exercising can reduce the risk of falls, especially in the elderly after surgery and the Pilates exercises focus on core strength and stability and the original fundamental principles proposed by Pilates are whole body movement, breathing, balanced muscle development, concentration, control, centering, precision, and rhythm [38].

Further, sensorimotor training can also be used to reduce the risk of falls and increase the stability of the hip joint [15].

Lastly, proprioceptive neuromuscular facilitation (PNF), is an important therapeutical technique which is seen to improve motor function in patients after surgery and this study showed that applied (PNF) therapy, including dynamic (eccentric, concentric) and static muscle training, post-isometric relaxation and stabilization resulted in improve hip joint mobility, muscle strength and gait [19].

3. Special part (case study)

3.1 Methodology

The clinical part of this case study was conducted from January 9, 2023, to February 3, 2023, at the Thomayerova Hospital in Prague. The physiotherapeutic procedures that were carried out on a 74-year-old patient who was diagnosed with a per trochanteric fracture of the proximal right femur on the right hip following a fall are described in detail in this case report. And the patient underwent a surgery which was treated by dynamic hip screw as surgical fixation. There were 11 physiotherapeutic sessions carried out in all during that time. The patient's recovery from the previous session largely determined the frequency, intensity, and volume of the physiotherapeutic treatments. The duration of the therapy ranged from 1 hour to 1 hour and 30 minutes. Furthermore, measuring tape, neurological hummer, a goniometer, overball, TheraBand, big ball and red cord were the equipments which were utilized to carry out all the assessments and therapy sessions which was done on the patient. The techniques used in the physiotherapy sessions include Post isometric relaxation technique, joint mobilization according to Lewit, strengthening exercises, conditional training exercises, stretching, sensomotoric stimulation exercises and physical therapy in the form of hydrotherapy. These techniques were chosen to help patients reach their therapeutic objectives, which was to increase the range of motion of the right hip joint and increase the allowable weight bearing in the affected right side.

Finally, I have submitted the signed consent form to the ethics committee, and it has been approved and signed by them. The approval registration number of the ethics committee is 047/2023

3.2 Anamnesis

Examined person: J.P

Year of birth: 1949

Gender: Female

Diagnosis: osteosynthesis of pertrochanteric fracture of proximal femur on the right side (7 days after operation)

Status Presents:

Objective:

- Height: 168cm
- Weight: 92 Kg
- BMI: 32.6kg/m²
- Glasses: yes
- Aids: she uses a 4-wheel forearm walker due to operation

Subjective:

The patient is one week after the operation of osteosynthesis of per trochanteric fracture of proximal femur on the right side. The patient is one week after the operation. She feels pain and discomfort in the right operated hip which is the pain 3 out of 10 in the scale of pain while she is laying in the bed in supine position. But she feels the pain more intensively while she is walking by the walker in the morning (the pain is rated 5 out of 10 while she is walking). also, she feels pain during active and passive movement of the operated leg.

But sometimes the pain increases during night to the point that she cannot sleep, and she has to take painkiller, so she will be able to sleep. (The pain rated 6 out of 10)

Chief complaint: The patient had a fall in the bathroom and felt pain near the right hip and she could not bear weight or do any movement without pain. She also observed edema over the painful area. It resulted in a pertrochanteric fracture of the proximal femur. She went for an operation on 08/01/2023 using dynamic hip screw.

History Anamnesis:

The patient was accepted to Thomayerova hospital on 08/01/2023 due to fall in the bathroom which resulted in a per trochanteric fracture of proximal femur in the right side. The patient underwent a surgery at the same day without any complications. Then they transferred her to rehabilitation department on 11/01/2023.

Occupation anamnesis: she is retired, but she was working before as teacher in high school.

Social anamnesis: she lives with her husband in apartment on the 7 th floor, and there is access for elevator. And they got no children

Family Anamnesis: her husband got amputated leg due to diabetes type 2 and he is using wheelchair, otherwise there is no significant disease in the family.

Injury anamnesis:

- per trochanteric fracture of proximal femur in the right side (08/01/2023).
- Fracture of the right proximal wrist (Date N/A), more than 7 years ago).
- Fracture of the right humerus (Date N/A), more than 5 years ago).
- Fracture of the metatarsal heads of the left leg (Date N/A, more than 10 years ago).

Past medical and surgical history:

- She underwent a surgical operation of per trochanteric fracture of proximal femur in the right side (08/01/2023).
- she got operated to remove hemorrhoids in 2000
- she had operation for tonsillitis (Date N/A, more than 40 years ago)

Allergy Anamnesis: None

Pharmacological Anamnesis:

- Siranalen 150mg
- Atorvastatin 40mg
- Airflusan forspiro 50ug/250ug
- Plus, she is taking medication for prevention from thromboembolism.

Abuses: smoke 5-7 cigarettes a day. But in the last 3 days, she did not smoke.

Sports, regular physical activity: she is not physically active

Hobbies: Reading

Diet: None

Functional Anamneses: she did not have any physical limitations in her daily life before the operation. But due to recent operation, there is a significant impairment of the ability to independently perform basic daily activities such as mobility (walking, standing), dressing and bathing.

Prior Rehabilitation:

She had postoperative rehabilitation at rehabilitation department on 11/01/2023 at thomayerova hospital. And the therapeutic procedures that was applied on the patient consisted of:

- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises for weakened muscles of the affected lower extremity (gluteal muscles, hip flexor, quadriceps femoris, hamstring, external and internal rotators muscles of the hip joint)
- Static stretching for shortened muscles (hamstring, triceps saure, rectus femoris and hip abductors).
- Active, active -assistive and passive movement for both lower extremities
- Mobilization such as Walking with 4-wheel walker

Final effect of the procedure:

- Slight increase in range of motion of the right hip joint in the direction of flexion and extension.

3.3 Initial Kinesiologic examination

3.3.1 Postural examination (Note: the patient is fully supported in 4-wheel walker)

Table 1: Postural examination-anterior view.

Base of support	Narrow base of support
Weight bearing	She puts most of the weight on the healthy side (Left side)
Position of the feet	Right foot is more abducted; therefore, she elevates the right heel from the ground. She tends to stand on tiptoes of the right foot.
Position and shape of toes	Slight Valgosity of both big toes, symmetrical shape for the rest of toes.
Position of knees	Slight Valgosity of the right and left knee.
The shape of thighs	The right thigh is bigger than left thigh in the shape. Due to edema in the operated right side.
Position of the hips	right hip is more externally rotated than left hip.
Position of umbilicus	Slightly shifted to the right side
Position and symmetry of the chest	Symmetrical
Position and symmetry of clavicles	Right clavicle is slightly higher than left clavicle.
Position and symmetry of the shoulders	Right shoulder is slightly higher than left shoulder.
Position of head	Neutral position (there is not tilting or shifting of the head)

Table 2: Postural examination-posterior view.

Base of support	She has narrow base of support
Weight bearing	She puts most of the weight on the healthy side
position of the heels	She elevates the right heel from the floor.
Shape and position of the ankle joint	Symmetrical shape of both ankles, neutral position for both ankles.
Contour of the calf muscles	Symmetrical on both sides
Shape and position of the knee joint	Slight Valgosity of the right and left knee
Shape of the posterior part of thigh	In the Right side, the posterior part of thigh is bigger than the left side.
Position of the hip joints	right hip is more externally rotated than left hip.
Position of spine	No deviation present
Position of both scapula	Right scapula is more prominent than left scapula.
Shoulder girdle position	Right shoulder is slightly higher than left shoulder
Head position	Neutral position of the head

Table 3: Postural examination-lateral view right.

Shape and position of the ankle joints	Physiological shape of the ankle Neutral position of the ankle.
Position of the knee joints	There is moderate flexion of the right knee.
Contour of the lateral thigh muscles	Physiological
Position of the pelvis	Moderate anterior tilt of the pelvis
Position of hip	Slightly flexed
Position and curvature of the T spine and L spine	Lordosis in the lumbar spine Slight kyphosis in upper thoracic spine
Position of the shoulder girdles	Slightly protracted
Position of the head	Slightly forward

Table 4: Postural examination-lateral view left.

Shape and position of the ankle joints	Physiological shape of the ankle Neutral position of the ankle
Position of the knee joints	Slight flexion of left knee
Contour of the thigh muscles	Physiological
Position of the pelvis	Moderate anterior tilt of the pelvis
Position of hip	Slightly flexed
Position and curvature of the T spine and L spine	Lordosis in the lumbar spine Slight kyphosis in upper thoracic spine
Position of the shoulder girdles	Slightly protracted
Position of the head	Slightly forward

3.3.2 Gait pattern Examination

Due to operation, the patient is using the 4-wheel walker for support. While walking the right knee is flexed. The right heel is elevated from the floor. She tends to use her tiptoes on the operated side for walk. Because she is putting most of weight on the healthy side, which causes a limp during the gait pattern. The upper limb is fully supported on 4-wheel walker.

3.3.3 Examination of the pelvis

Table 5: Examination of the pelvis.

Iliac crest	Left side is higher than right side
PSIS	Left Posterior Superior Iliac Spine (PSIS) is higher than right PSIS
ASIS	Left Anterior Superior Iliac Spine (ASIS) is higher than right ASIS
Pelvic tilt	ASIS and PSIS is higher in the left side than right side which causing pelvic tilt to the right side. Therefore, both PSIS is higher than ASIS. resulting to have anterior pelvic tilt as well.

3.3.4 Anthropometric measurements

Table 6: Circumference test.

Circumference (cm)	Right (cm)	Left (cm)
15 cm from knee cup	53	50.5
10 cm from knee cup	51	49
Around knee cup	46	45
Tibial tuberosity	35	34.5
Around calf muscles	41	40
Ankle Joint (around malleolus)	26	26

Table 7: Length test.

Length (cm)	Right (cm)	Left (cm)
Anatomical Length	83.5	83
Functional length (from ASIS to medial malleolus)	90	91
Functional Length (from umbilicus to medial malleolus)	98.5	98
Length of thigh	39	39
Length of middle leg	37.5	38

3.3.5 Examination of Goniometry

Table 8: Range of motion of the hip joint.

	Right (degree)	Left (degree)
Active	S:0-0-30; F:20-0-5; R:5-0-5	S:5-0-100; F:30-0-10; R: 20-0-20
Passive	S:5-0-65; F:25-0-10; R:10-0-10	S:10-0-110; F:35-0-15; R:25-0-20

Table 9: Range of motion of the knee joint.

	Right (degree)	Left (degree)
Active	S:0-0-80	S:0-0-100
Passive	S:0-0-90	S:0-0-120

Table 10: Range of motion of the Ankle joint.

	Right (degree)	Left (degree)
Active	S:10-0-35; R:20-0-30	S:10-0-40; R:20-0-30
Passive	S:15-0-40; R:30-0-35	S:15-0-45; R:30-0-35

3.3.6 Muscle strength test

Table 11: Muscle strength test (according to Janda).

Muscle	Right	Left
Quadriceps femoris	3+	4+
Biceps Femoris	2+	4
Medial Hamstrings	3+	4
Hip adductors	2	4
Hip abductors (Tensor fascia late)	2	4
Iliopsoas	2-	4
Gluteus maximus	2-	4+
External rotators (Piriformis)	2+	4+
Gluteus Medius	2+	4
Gluteus Minimums	2+	4
Tibialis anterior	4+	4+
Triceps Surae	4+	4+

3.3.7 Muscle length test

Table 12: Muscle length test (according to Janda and Kendall).

Muscle	Right	Left
Hamstring	Shortness	shortness
Hip flexor one joint	Grade 2 Shortness	Grade 2 shortness
Hip Flexor two joint	Grade 2 shortness	Grade 2 shortness
Hip adductors	Grade 2	Grade 1
Gastrocnemius	Grade 0 (no shortness)	Grade 0 (no shortness)
soleus	Grade 1	Grade 1

3.3.8 Muscle palpation

Table 13: Muscle tone palpation

Muscle	Right	Left
Rectus femoris	Normal tone	Normal tone
Vastus medialis	Hypotonic	Hypotonic
Vastus lateralis	Hypertonic	Normal tone
Biceps femoris	Hypotonic	Hypotonic
Semitendinosus	Hypotonic	Hypotonic
Semimembranosus	Hypotonic	Hypotonic
Piriformis	Hypotonic	Normal tone
Gluteus maximus	Hypotonic	Hypertonic
Gluteus Medius	Hypotonic	Hypertonic
Hip abductors	Hypotonic	Hypertonic
Hip adductors	Hypertonic	Hypertonic
Triceps surae	Hypertonic	Hypertonic

3.3.9 Neurological examination

Superficial sensation Examination

Table 14: Superficial sensation Examination

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

Deep sensation examination on the lower Extremity

Position sense: the patient was in supine position, firstly I hold the big toes of the patient and I showed her the direction of up and down. Then I asked the patient to close her eye then I moved the big toe up and down and the patient was able to know which direction it was. As well as I was changing between toes and the patient was able to know which toe was it and this test was performed in both sides.

Stereognosis: the patient was supine position, I asked the patient to close her eyes, then I gave her a common object (Key). And she was able to recognize it.

Kinesthesia: the patient was in supine position with her eyes closed, then I started to her big toe up and down. And she was able to know when the movement started and stopped. This test was performed on both sides.

Deep tendon reflexes examination

Table 15 : Deep sensation Reflexes examination.

	Right	Left
Knee jerk reflex (L3-L4)	Normal/3	Normal/3
Achilles reflex (L5-S2)	Normal/3	Normal/3
Plantar Reflex	Normal/3	Normal/3

3.3.10 Joint play examination

Table 16: Joint play examination (According to Lewit).

Joint play	Right	Left
patella	Restricted laterally and caudally, free medially and cranially	Restricted laterally and caudally, free medially and cranially
Head of fibula	Restricted in both directions anteriorly and dorsally	Restricted
Talocrural	Restricted	free
Subtalar	Restricted	free
Lisfranc	Restricted	Restricted
Chopart	Restricted	Restricted
Metatarsals	Free	Free

3.3.11 Soft tissue examination

Skin

In comparison with the healthy side, there is still a visible edema in the operated area (lateral part of the thigh) and hematoma is present around the scar. And the skin around the scar is in higher temperature. And the stitches still covered with plaster.

Around the scar (anterior part of thigh, anterior lateral part of thigh and medial part of the thigh), the skin is restricted in all directions in the right side. On the other hand, the skin of thigh on the healthy side (anterior part of thigh, anterior lateral part of thigh and medial part of the thigh), there is no restriction in all direction.

Fascia

Table 17: Fascia examination (According to Lewit).

	Right	Left
Upper anterior part of thigh	Restricted	Slightly restricted
Lower anterior part of thigh	Restricted	slightly restricted
Posterior part of thigh	Slightly restricted	No restriction
Achilles tendon	No restriction	No restriction

3.4 Conclusion of the initial examination.

According to the initial kinesiological examination and the medical history, the patient underwent operation on 08/01/2023 due to pertrochanteric fracture of the proximal right femur. From circumferences examination, in comparison with healthy side there is a visible edema as well as higher temperature on the right thigh around the scar (anterior lateral part of thigh, upper and lower anterior part of thigh); in addition, hematoma was present on the lateral part of thigh.

From gait examination, we found out that her right knee is moderately flexed and the right heel off the ground, she tends to walk on tiptoes on the operated side and she is putting most of her weight on the healthy side which resulting in limping during the gait.

From ROM examination, with comparison with the healthy side, there is significant limitation in the range of motion of right hip joint (in the direction of flexion, extension, and external and internal rotation) which is due to recent operation. Furthermore, due to operation, there is a significant muscle weakness in the operated side, which resulting in muscle imbalance overall the lower extremities.

From palpation of muscle tone, the right lower extremity (operated side) has a lower tone in the muscles in comparison with left side. (healthy side).

All neurological examinations were negative. From the joint play examination, we found out that both patella was restricted laterally and caudally, and head of fibula was restricted on both sides. As well as Lisfranc and Chopart joint was restricted on both extremities. Moreover, from the soft tissue examination, the skin (anterior part of thigh, anterior lateral part of thigh and medial part of the thigh), was restricted in all direction as well as the fascia on the operated area (Upper anterior part of thigh, Lower anterior part of thigh and Posterior part of thigh) was restricted. Lastly there is a significant impairment of the ability to perform basic daily activities independently such as walking, going to bathroom, bathing and dressing but she manages to transfer herself from the bed to a seated toilet which is next to bed without any assistance.

3.5 Short term Rehabilitation Goals

- Reduce edema and hematoma on the right thigh around the scar
- increase the range of motion of the right hip joint.
- improve the strength of the weakened muscles in the right leg (quadriceps femoris, medial hamstring, biceps femoris, gluteal muscles, adductor and abductor muscles, iliopsoas, piriformis).
- Reduce the tonicity of the hypertonus muscles (right vastus lateralis, hip adductors, triceps surae, left gluteus maximus, left gluteus medius, left abductor muscles)
- Increase the tonicity of the hypotonus muscles (vastus medialis, biceps femoris, semitendinosus, semimembranosus, left piriformis, left gluteus maximus and medius and left hip abductor muscles).
- Increase the length of the shortened muscles in both legs (hip flexor one joint and two joint, hamstring, hip adductors, soleus muscle).
- Restore the mobility of the restricted fascia (upper anterior part of thigh, lower anterior part of thigh and posterior part of thigh) of right leg.
- improve the flexibility of the soft tissue around the scar (note: when the plaster will be removed, and the scar is not active)
- improve the gait pattern.
- Release the restrictions in the joints in the right lower extremity (patella, head of fibula, talocrural joint, subtalar joint, Lisfranc, Chopart joints)

3.5.1 Short-term Rehabilitation Plan

- Soft tissue techniques to release restricted skin and fascia
- Scar therapy
- Strengthening exercises for weakened Muscles
- Stretching exercises for shortened muscles
- Post Isometric Relaxation (PIR) to relax hypertonus muscles
- Mobilization techniques for restricted joints
- Hydrotherapy – Walking on treadmill while submerged in water to improve weight bearing and gait pattern. (15 minutes at a speed of 2km/h)
- balance and stability exercises.

3.5.2 Long-term Rehabilitation goals

- Reduce risk of falls in the future
- Return to activities of daily living with minimum limitations
- Improve quality of life as much as possible
- Improve overall physical condition

3.5.3 Long-term Rehabilitation plan

- Follow up with therapy till we can add advanced level of progressive resistance exercises after there will be quite improvement in the strength of muscles and increased range of motion and flexibility in the joint to increase the strength of both lower extremity to
- follow up with the therapy till we can increase the difficulty of balance and stability exercises to prepare the patient for any unexpected fall which could lead to fracture again in the future and to prevent any future fall.

3.6 Day to Day Therapy

Date: 17/01/2023

Stp. Sub: the patient feels pain around the operated area in the right leg while she is lying in supine position which is rated 3 out 10 in the scale of pain. And she feels weakness overall the operated leg.

Stp. Obj: there is significant limitation in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is visible edema and hematoma in the operated side around the scar (which is still covered with plaster). In addition, the skin around the scar is restricted in all directions. Lastly the patient was able to stand with assistance of 4-wheel walker.

Goal of today's therapy unit:

- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Mobilization of restricted joints in both legs (patella, head of fibula, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints)
- Slightly increase the range of the motion of the right hip joint

Proposed Therapy for today therapy unit:

- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, abduction and adduction)
- Mobilization techniques for restricted joints (according to Lewit)

Description of today's therapeutic unit:

- Soft Tissue techniques

While the patient was in supine position, I started by rolling the soft ball on the operated side from the distal part (anterior part of thigh, anterior lateral part of thigh and medial part of the thigh) to proximal part around the scar.

- Active exercises for both legs (in supine position)

- Ankle dorsal and plantar flexions – 10 times
- Ankle rotations – 10 times in both directions
- Knee flexions and extensions – 5 times

- Active assisted exercises for both legs (in supine position)

- Hip abduction and adduction – 5 times
- Knee flexions and extensions – 5 times

- Passive exercises for both legs

- Supine hip flexion – 5 times
- Prone hip extension – 5 times

- Strengthening exercises

- Lying in supine with knees flexed and overball between the legs. Patient squeezes the ball between her legs to strengthen adductors and then relax – 8 times
- Lying in supine with knees flexed and theraband around the knees. Patient pushes against theraband to strengthen abductors and then relax – 8 times
- Lying in supine with knees extended and overball under the right knee. Patient pushes the knee down to strengthen quadriceps and then relax – 8 times
- Lying in supine with knees extended and overball under the right ankle. Patient pushes down on the ball then relaxes and flex the knee to strengthen hamstrings. – 8 times

- Lying in supine with knees flexed. Patient lifts hips to strengthen the gluteus maximus and then relax. – 8 times
- Lying in prone with toes on the table. Extension of knee to strengthen quadriceps then relax. – 8 times
- Static stretching
 - Hamstrings – Supine position with knee extended, passive hip flexion till the barrier and hold for 30 seconds
 - Rectus femoris – Prone position, passive knee flexion till the barrier and hold for 30 seconds
 - Hip adductors – Supine position with knee extended, passive hip abduction till the barrier and hold for 30 seconds
 - Triceps surae – Supine position, passive ankle dorsiflexion till the barrier and hold for 30 seconds
- Joint mobilizations
 - Lisfranc joint – Both lower extremities
 - Chopart joint – Both lower extremities
 - Subtalar joint – Right lower extremity
 - Talocrural joint – Right lower extremity
 - Head of fibula – Both lower extremities (in the anterior and dorsal direction)
 - Patella – Both lower extremities (in the lateral and caudal direction)

Results of therapy:

Subjective – Patient felt very tired after the therapy. She felt slight pain during certain exercises especially when returning to the neutral position during passive hip flexion.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion. Slightly increased mobility in the patella laterally and caudally, head of fibula anteriorly and dorsally, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints on the right lower extremities.

Self-therapy:

Active movements of peripheral parts of both lower extremities (ankles, knees)

- Ankle rotations in both direction – 10 times
- Ankle plantar flexion and dorsal flexion – 10 times
- Knee flexion and extension – 10 times

Date: 18/01/2023

Stp. Sub: the patient feels pain around the operated area in the right leg while she is lying in supine position which is rated 3 out 10 in the scale of pain. And she feels weakness overall the operated leg. The previous night, she felt pain and could not sleep so she took a painkiller which helped her sleep.

Stp. Obj: there is significant limitation in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is visible edema and hematoma in the operated side around the scar (which is still covered with plaster). In addition, the skin around the scar is restricted in all directions. Lastly the patient was able to stand with assistance of 4-wheel walker.

Goal of today's therapy unit:

- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Mobilization of restricted joints in both legs (patella, head of fibula, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints)
- Slightly increase the range of the motion of the right hip joint
- Relax hypertonic hip adductors, triceps surae and gluteus maximus of the left lower extremity

Proposed Therapy for today therapy unit:

- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- Mobilization techniques for restricted joints (according to Lewit)
- PIR of hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity

Description of today's therapeutic unit:

- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Joint mobilizations – Same as previous session
- Passive internal and external rotation of the right hip joint
- PIR of muscles of left lower extremity
 - Gluteus maximus – Patient lying in prone position with the heels rotated outward. Using crossed hands, I applied pressure on the buttocks and asked the patient to clench the buttocks and hold this contraction. After 10 seconds the patient took a deep breath in then breathed out and relaxed. It was repeated 3 times.
 - Hip adductors – Patient is lying in supine position with the leg passively abducted to stretch the adductors. I asked the patient to push the leg inwards into adduction while I gave resistance. After 10 seconds the patient took a deep breath in then breathed out and relaxed. It was repeated 3 times.

- Triceps surae – Patient is lying in supine position with the ankle passively dorsiflexed to stretch the triceps surae. I asked the patient to push her toes down to go into plantar flexion of the ankle. After 10 seconds the patient took a deep breath in then breathed out and relaxed. It was repeated 3 times.
- Rotoped (bicycle)
 - Upper extremities – 10 minutes
 - Lower extremities – 5 minutes

Results of therapy:

Subjective – Patient felt slightly tired after the therapy. She felt slight pain during certain exercises especially when returning to the neutral position during passive hip flexion.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion. Slightly increased mobility in the patella laterally and caudally, head of fibula anteriorly and dorsally, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints on the right lower extremities. Slight reduction of tonicity of gluteus maximus, hip adductors and triceps surae on the left lower extremity.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees).

- Ankle rotations in both direction
- Ankle plantar flexion and dorsal flexion
- Knee flexion and extension

Date: 19/01/2023

Stp. Sub: the patient feels pain around the operated area in the right leg while she is lying in supine position which is rated 2 out 10 in the scale of pain. And she feels weakness overall the operated leg.

Stp. Obj: there is significant limitation in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is reduced edema and hematoma in the operated side around the scar (which is still covered with plaster). In addition, the skin around the scar is slightly restricted in all directions. Lastly the patient was able to stand with assistance of 4-wheel walker.

Goal of today's therapy unit:

- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Mobilization of restricted joints in both legs (patella, head of fibula, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints)
- Slightly increase the range of the motion of the right hip joint
- Relax hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity

Proposed Therapy for today therapy unit:

- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- Mobilization techniques for restricted joints (according to Lewit)
- PIR of hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity muscles

Description of today's therapeutic unit:

- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Joint mobilizations – Same as previous session
- PIR – Same as previous session
- Rotoped (bicycle) – Same as previous session

Results of therapy:

Subjective – Patient felt slightly tired after the therapy. She felt slight pain during certain exercises especially when returning to the neutral position during passive hip flexion.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion. Slightly increased mobility in the patella laterally and caudally, head of fibula anteriorly and posteriorly, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints on the right lower extremities. Slight reduction of tonicity of gluteus maximus, hip adductors and triceps surae on the left lower extremity muscles.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction – 10 times
- Ankle plantar flexion and dorsal flexion – 10 times
- Knee flexion and extension – 10 times

Date: 20/01/2023

Stp. Sub: the patient feels slight pain around the operated area in the right leg while she is lying in supine position which she described as pressure and discomfort. And she feels weakness overall the operated leg. The previous night she slept very well, and she was ready for the therapy.

Stp. Obj: there is limitation in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is reduced edema and hematoma in the operated side around the scar (which is still covered with plaster). In addition, the skin around the scar is slightly restricted in all directions. Lastly the patient was able to stand with assistance of 4-wheel walker.

Goal of today's therapy unit:

- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Mobilization of restricted joints in both legs (patella, head of fibula, right talocrural joint, right subtalar joint, Lisfranc and chopart joints)
- Slightly increase the range of the motion of the right hip joint
- Relax hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity

Proposed Therapy for today therapy unit:

- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)

- Mobilization techniques for restricted joints (according to Lewit)
- PIR of hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Walking with 4-wheel walker

Description of today's therapeutic unit:

- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Joint mobilizations – Same as previous session
- PIR – Same as previous session
- Rotoped (bicycle) – Same as previous session
- Walking with assistance of 4-wheel walker until patient was tired

Results of therapy:

Subjective – Patient felt slightly tired after the therapy. She felt slight pain during certain exercises especially when returning to the neutral position during passive hip flexion.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion. Slightly increased mobility in the patella laterally and caudally, head of fibula anteriorly and dorsally, right talocrural joint, right subtalar joint, Lisfranc and chopart joints on the right lower extremities. Slight reduction of tonicity of gluteus maximus, hip adductors and triceps surae on the left lower extremity.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction – 10 times
- Ankle plantar flexion and dorsal flexion – 10 times
- Knee flexion and extension – 10 times

Date: 23/01/2023

Stp. Sub: the patient feels slight pain around the operated area in the right leg while she is lying in supine position which she described as pressure and discomfort. And she feels less weakness overall the operated leg but she felt less tired after resting over the weekend.

Stp. Obj: there is slight limitation in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is reduced edema and hematoma in the operated side around the scar. In addition, the skin around the scar is slightly restricted in all directions. Lastly the patient was able to stand with assistance of 4-wheel walker. The plaster was removed before the session.

Goal of today's therapy unit:

- Scar examination
- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Mobilization of restricted joints in both legs (patella, head of fibula, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints)
- Slightly increase the range of the motion of the right hip joint
- Relax hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Improve stability of the hip

Proposed Therapy for today therapy unit:

- Scar treatment
- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching

- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- Mobilization techniques for restricted joints (according to Lewit)
- PIR of hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Sensorimotor stimulation
- Walking with 4-wheel walker

Description of today's therapeutic unit:

- Scar examination – The patient had 3 scars located on the lateral aspect of the thigh. The first scar was located above the major trochanter and was 6cm long. The other two scars were smaller, located 3cm caudally. One was 3cm long while the most caudal one was 2cm long. All three scars were restricted in all directions throughout.
- Scar treatment.
- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Joint mobilizations – Same as previous session
- PIR – Same as previous session
- Rotoped (bicycle) – Same as previous session
- Walking – Same as previous session
- Sensorimotor stimulation:
 - Sitting on a big ball – shifting weight forwards, backwards and to the sides – 10 times each
 - Sitting on a big ball – lifting the body slightly (1-2cm) from the ball and sitting again – 6 times
 - Sitting on a big ball – walking forwards and backwards – 5 times

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She did not feel much pain, just discomfort during the end position of passive hip flexion and hip extension.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion, internal and external rotation. No more restriction in the patella in the lateral and caudal direction, head of fibula in the anterior and dorsal direction, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints. Slight reduction of tonicity of gluteus maximus, hip adductors and triceps surae on the left lower extremity. Slight improvement in mobility of scars.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Date: 24/01/2023

Stp. Sub: the patient feels slight discomfort around the operated area in the right leg while she is lying in supine position and sometimes feels pressure over the area. And she feels less weakness overall the operated leg, but she felt tired after the previous session.

Stp. Obj: there is an improvement in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is significantly reduced edema and hematoma in the operated side around the scar. In addition, the skin around the scar is less restricted in all directions. There is no longer restriction in the joints (patella, head of fibula, right talocrural joint, right subtalar joint, Lisfranc and Chopart joints). Lastly, the patient was able to stand with assistance of 4-wheel walker.

Goal of today's therapy unit:

- Scar treatment
- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Slightly increase the range of the motion of the right hip joint
- Relax hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Improve stability of the hip

Proposed Therapy for today therapy unit:

- Scar treatment
- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- PIR of hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Walking with 4-wheel walker
- Sensorimotor stimulation

Description of today's therapeutic unit:

- Scar treatment – Same as previous session
- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session

- Static stretching – Same as previous session
- PIR – Same as previous session
- Rotoped (bicycle) – Same as previous session
- Walking – Same as previous session
- SMS – Same as previous session

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She did not feel much pain, just discomfort during the end position of passive hip flexion and hip extension. She was happy with the progress she was making

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion, extension, internal and external rotation. Slight reduction of tonicity of gluteus maximus, hip adductors and triceps surae on the left lower extremity. Slight improvement in mobility of scars.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Active movements of both upper extremities (shoulders, elbows and wrists)

- Shoulder abduction, flexion, extension and horizontal adduction - 10 times
- flexion and extension of the elbow - 10 times
- Flexion, extension, radial duction and ulnar duction of the wrist - 10 times

Date: 25/01/2023

Stp. Sub: the patient still feels slight discomfort around the operated area in the right leg while she is lying in supine position and sometimes feels pressure over the area. And she feels a significant improvement in the strength of the operated lower extremity.

Stp. Obj: there is an improvement in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is significantly reduced edema and hematoma in the operated side around the scar. In addition, the skin around the scar is less restricted in all directions. There was reduced hypertone of the gluteus maximus, hip adductors and triceps surae in the left lower extremity and increased tone of the vastus medialis, hamstrings, piriformis, gluteus maximus, gluteus medius, hip abductors, hip adductors. Lastly, the patient was able to stand with assistance of 4-wheel walker.

Goal of today's therapy unit:

- Scar treatment
- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Slightly increase the range of the motion of the right hip joint
- Relax hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Improve stability of the hip

Proposed Therapy for today therapy unit:

- Scar treatment
- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching

- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- PIR of hypertonic hip adductors, triceps surae and gluteus maximus of left lower extremity
- Walking with 4-wheel walker
- Sensorimotor stimulation

Description of today's therapeutic unit:

- Scar treatment – Same as previous session
- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- PIR – Same as previous session
- Rotoped (bicycle) – Same as previous session
- Walking – Same as previous session
- SMS – Same as previous session

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She only felt slight discomfort during the end position of passive hip flexion and hip extension. She was happy with the progress she was making

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion, extension, internal and external rotation. No more hypertone in the gluteus maximus, hip adductors and triceps surae on the left lower extremity. Improvement in mobility of scars and soft tissue.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Active movements of both upper extremities (shoulders, elbows and wrists)

- Shoulder abduction, flexion, extension and horizontal adduction - 10 times
- flexion and extension of the elbow - 10 times
- Flexion, extension, radial duction and ulnar duction of the wrist - 10 times

Date: 26/01/2023

Stp. Sub: the patient still feels slight discomfort around the operated area in the right leg while she is lying in supine position and sometimes feels pressure over the area. And she feels a significant improvement in the strength of the operated lower extremity.

Stp. Obj: there is an improvement in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation and internal rotation) moreover, there is significantly reduced edema and hematoma in the operated side around the scar. In addition, the soft tissue around the scar is less restricted in all directions. There was no more hypertone of the gluteus maximus, hip adductors and triceps surae in the left lower extremity. Further, the patient started to use a 4-leg walker without wheels.

Goal of today's therapy unit:

- Scar treatment
- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Slightly increase the range of the motion of the right hip joint
- Gait training with 4-leg walker without wheels
- Improve stability of the hip

Proposed Therapy for today therapy unit:

- Scar treatment
- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- Walking with 4-leg walker without wheels
- Sensorimotor stimulation

Description of today's therapeutic unit:

- Scar treatment – Same as previous session
- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Rotoped (bicycle) – Same as previous session
- SMS – Same as previous session
- Gait training and walking using 4 leg walker without wheels. (I instructed the patient how to gradually increase weight bearing on the operated extremity during standing and gait – The gait pattern followed was to first put the walker in front then the operated leg and finally the healthy leg)

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She only felt slight discomfort during the end position of passive hip flexion and hip extension. She was happy with the progress

she was making but a bit tired because it was difficult for her to adjust to walking with the 4 leg walker.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion, extension, internal and external rotation. Improvement in mobility of scars and soft tissue. Significant improvement of strength in the right lower extremity.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Active movements of both upper extremities (shoulders, elbows and wrists)

- Shoulder abduction, flexion, extension and horizontal adduction - 10 times
- flexion and extension of the elbow - 10 times
- Flexion, extension, radial duction and ulnar duction of the wrist - 10 times

Date: 27/01/2023

Stp. Sub: the patient still feels slight discomfort around the operated area in the right leg while she is lying in supine position and sometimes feels pressure over the area. And she feels a significant improvement in the strength of the operated lower extremity. She was in a good mood as she felt happy to be able to walk with the 4-leg walker without wheels as it made her feel more independent.

Stp. Obj: there is an improvement in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation, and internal rotation) moreover, there is significantly reduced edema and hematoma in the operated side around the scar. In addition, the soft tissue around the scar is less restricted in all directions. The scars are almost completely free with only slight restriction in the proximal part of the long scar.

Goal of today's therapy unit:

- Scar treatment
- Release restriction of the soft tissue around the scar
- Reduce edema and hematoma
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Slightly increase the range of the motion of the right hip joint
- Walking with 4-leg walker without wheels
- Improve stability of the hip

Proposed Therapy for today therapy unit:

- Scar treatment
- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active, active assisted and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction, and adduction)
- Walking with 4-leg walker without wheels
- Sensorimotor stimulation

Description of today's therapeutic unit:

- Scar treatment – Same as previous session
- Soft tissue techniques - Same as previous session
- Active exercises – Same as previous session
- Active assisted exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Rotoped (bicycle) – Same as previous session
- SMS – Same as previous session

- Walking – Same as previous session

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She only felt slight discomfort during the end position of passive hip flexion and hip extension. She was happy with the progress she was making but she felt very tired today after walking with the 4-leg walker without wheels.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion, extension, internal and external rotation. Significant improvement in mobility of scars and soft tissue.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Active movements of both upper extremities (shoulders, elbows and wrists)

- Shoulder abduction, flexion, extension and horizontal adduction - 10 times
- flexion and extension of the elbow - 10 times
- Flexion, extension, radial duction and ulnar duction of the wrist - 10 times

Date: 30/01/2023

Stp. Sub: the patient still feels slight discomfort around the operated area in the right leg while she is lying in supine position and sometimes feels pressure over the area. And she feels a significant improvement in the strength of the operated lower extremity. She was in a good mood and was well rested over the weekend.

Stp. Obj: there is an improvement in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation, and internal rotation) moreover, there is significantly reduced edema and no more hematoma in the operated side around the scar. In addition, the soft tissue around the scar is almost free in all directions. The scars are almost completely free with only slight restriction in the proximal part of the long scar.

Note: hydrotherapy was started on this day – patient was submerged in a water tank until her shoulders and walked on a treadmill while holding bars at the side for support to train the proper gait pattern with equal loading of both extremities. This was done for 15 minutes, and the treadmill speed was 2 km/h.

Goal of today's therapy unit:

- Scar treatment
- Release restriction of the soft tissue around the scar
- Reduce edema
- Strengthening the weakened muscles
- Stretching the shortened muscles
- Slightly increase the range of the motion of the right hip joint
- Improve stability of the hip
- Hydrotherapy

Proposed Therapy for today therapy unit:

- Scar treatment
- Soft Tissue technique by soft ball was applied on the right thigh (around the scar) and knee.
- Strengthening exercises
- Static stretching
- Active and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- Exercises using red cord
- Sensorimotor stimulation

- Hydrotherapy – 15 minutes walking submerged in water at 2km/hr

Description of today's therapeutic unit:

- Scar treatment
- Soft tissue techniques to release restricted soft tissue around the scar
- Active exercises (in supine position)
 - Ankle dorsal and plantar flexions – 10 times
 - Ankle rotations – 10 times in both directions
 - Knee flexions and extensions – 10 times
- Passive exercises
 - Supine hip flexion – 10 times
 - Prone hip extension – 10 times
- Strengthening exercises
 - Lying in supine with knees flexed and overball between the legs. Patient squeezes the ball between her legs to strengthen adductors and then relax – 10 times
 - Lying in supine with knees flexed and theraband around the knees. Patient pushes against TheraBand to strengthen abductors and then relax – 10 times
 - Lying in supine with knees extended and overball under the right knee. Patient pushes the knee down to strengthen quadriceps and then relax – 10 times
 - Lying in supine with knees extended and overball under the right ankle. Patient pushes down on the ball then relaxes and flex the knee to strengthen hamstrings. – 10 times
 - Lying in supine with knees flexed. Patient lifts hips to strengthen the gluteus maximus and then relax. – 10 times
 - Lying in prone with toes on the table. Extension of knee to strengthen quadriceps then relax. – 10 times
 - Lying in prone with overball between ankles. Knee flexion to strengthen the hamstrings. – 10 times

- Red cord:
 - Supine position with red cord around both ankles. Abduction and adduction of both lower extremities using the assistance of the red cord to improve range of motion – 10 times each leg
 - Side lying position (lying on the healthy leg) with red cord around ankle and knee of the operated leg. Hip flexion and extension using the assistance of the red cord to improve range of motion – 10 times (only on the operated side)
 - Supine position with red cord under both heels. Knee flexion and extension with flexion and extension of the hip to improve range of motion – 10 times each leg
- Static stretching
 - Hamstrings – Supine position with knee extended, passive hip flexion till the barrier and hold for 30 seconds
 - Rectus femoris – Prone position, passive knee flexion till the barrier and hold for 30 seconds
 - Hip adductors – Supine position with knee extended, passive hip abduction till the barrier and hold for 30 seconds
 - Triceps surae – Supine position, passive ankle dorsiflexion till the barrier and hold for 30 seconds
- Hydrotherapy – Walking while submerged underwater for 15 minutes on a treadmill at 2km/hr.

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She only felt slight discomfort during the end position of passive hip flexion and hip extension. She was happy with the progress she was making and enjoyed the hydrotherapy.

Objective – Slight increase in range of motion of the right hip joint in the direction of flexion, extension, internal and external rotation. No more restriction in the soft tissue and scars.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Active movements of both upper extremities (shoulders, elbows and wrists)

- Shoulder abduction, flexion, extension and horizontal adduction - 10 times
- flexion and extension of the elbow - 10 times
- Flexion, extension, radial duction and ulnar duction of the wrist - 10 times

Date: 31/01/2023

Stp. Sub: The patient is happy with the progress she has made so far and was excited for her last session. She still felt slight discomfort over the operated area, but it was only felt sometimes mainly during walking but not at rest.

Stp. Obj: there is an improvement in the range of motion of the right hip joint (in the direction of flexion, extension, external rotation, and internal rotation) moreover, there is no more edema in the operated side around the scar. In addition, the soft tissue around the scar is free in all directions. The scars are completely free. She started walking with crutches in this session.

Goal of today's therapy unit:

- Strengthening the weakened muscles
- Stretching the shortened muscles
- Slightly increase the range of the motion of the right hip joint
- Gait training using crutches
- Improve stability of the hip

Proposed Therapy for today therapy unit:

- Strengthening exercises
- Static stretching
- Active and passive movements for right hip joint (in the direction of flexion, extension, internal rotation, external rotation, abduction and adduction)
- Exercises using red cord
- Gait training with crutches
- Sensorimotor stimulation

Description of today's therapeutic unit:

- Soft tissue techniques - Same as previous session
- Scar treatment – Same as previous session
- Active exercises – Same as previous session
- Red cord exercises – Same as previous session
- Passive exercises – Same as previous session
- Strengthening exercises – Same as previous session
- Static stretching – Same as previous session
- Gait training with crutches – I instructed the patient how to use the crutches to walk by first putting the crutches in front then the operated leg and finally the healthy leg. While I was holding her for extra support as she was scared.

Results of therapy:

Subjective – Patient felt satisfied after the therapy. She felt exhausted after using the crutches and had to take breaks during the walking, but she was happy with the progress she was made during all the therapy sessions.

Objective – Improvement in range of motion in the right hip joint. Improved strength and stability of the right lower extremity. Improved loading and weight bearing on the operated leg.

Self-therapy:

Active movements of peripheral parts of lower extremity (ankles, knees)

- Ankle rotations in both direction - 10 times
- Ankle plantar flexion and dorsal flexion - 10 times
- Knee flexion and extension - 10 times

Active movements of both upper extremities (shoulders, elbows and wrists)

- Shoulder abduction, flexion, extension and horizontal adduction - 10 times
- flexion and extension of the elbow - 10 times
- Flexion, extension, radial duction and ulnar duction of the wrist - 10 times

3.7 Final Kinesiologic examination:

3.7.1 Postural examination (Note: the patient is supported by crutches)

Table 18: Final postural examination-anterior view.

Base of support	Narrow base of support
Weight bearing	She puts slightly more weight on the healthy side (Left side)
Position of the feet	Right foot is more abducted; she still slightly elevates the right heel while standing.
Position and shape of toes	Slight Valgosity of both big toes, symmetrical shape for the rest of toes.
Position of knees	Slight Valgosity of the right and left knee.
The shape of thighs	The right thigh looks symmetrical to the left side.
Position of the hips	right hip is more externally rotated than left hip.
Position of umbilicus	Slightly shifted to the right side
Position and symmetry of the chest	Symmetrical
Position and symmetry of clavicles	Right clavicle is slightly higher than left clavicle.
Position and symmetry of the shoulders	Right shoulder is slightly higher than left shoulder.
Position of head	Neutral position (there is not tilting or shifting of the head)

Table 19: Final postural examination-posterior view.

Base of support	She has narrow base of support
Weight bearing	She puts slightly more weight on the healthy side
position of the heels	She slightly elevates the right heel from the floor.
Shape and position of the ankle joint	Symmetrical shape of both ankles, neutral position for both ankles.
Contour of the calf muscles	Symmetrical on both sides
Shape and position of the knee joint	Slight Valgosity of the right and left knee
Shape of the posterior part of thigh	In the Right side, the posterior part of thigh is bigger than the left side.
Position of the hip joints	right hip is more externally rotated than left hip.
Position of spine	No deviation present
Position of both scapula	Right scapula is more prominent than left scapula.
Shoulder girdle position	Right shoulder is slightly higher than left shoulder
Head position	Neutral position of the head

Table 20: Final postural examination-lateral view right.

Shape and position of the ankle joints	Physiological shape of the ankle Neutral position of the ankle.
Position of the knee joints	There is slight flexion of the right knee.
Contour of the lateral thigh muscles	Physiological
Position of the pelvis	Moderate anterior tilt of the pelvis
Position of hip	Slightly flexed
Position and curvature of the T spine and L spine	Lordosis in the lumbar spine Slight kyphosis in upper thoracic spine
Position of the shoulder girdles	Slightly protracted
Position of the head	Slightly forward

Table 21: Final postural examination-lateral view left.

Shape and position of the ankle joints	Physiological shape of the ankle Neutral position of the ankle
Position of the knee joints	Full extension of left knee
Contour of the thigh muscles	Physiological
Position of the pelvis	Moderate anterior tilt of the pelvis
Position of hip	Slightly flexed
Position and curvature of the T spine and L spine	Lordosis in the lumbar spine Slight kyphosis in upper thoracic spine
Position of the shoulder girdles	Slightly protracted
Position of the head	Slightly forward

3.7.2 Gait pattern Examination

The final gait examination was done using crutches for support. While walking the right knee is slightly flexed. She is able to load the operated side more with only slight elevation of the heel during gait. She still tends to load the healthy side more, but it is more symmetrical than it was before the therapy started. She still walks with a slight limp. The upper limbs are holding crutches for support. The patient was using a three-point gait pattern (crutches first then operated leg and finally healthy leg)

3.7.3 Examination of the pelvis

Table 22: Final examination of the pelvis.

Iliac crest	Left side is higher than right side
PSIS	Left PSIS is higher than right PSIS
ASIS	Left ASIS is higher than right ASIS
Pelvic tilt	ASIS and PSIS is higher in the left side than right side which causing pelvic tilt to the right side. Therefore, both PSIS is higher than ASIS. resulting to have anterior pelvic tilt as well.

3.7.4 Anthropometric measurements

Table 23: Final circumference test.

Circumference (cm)	Right (cm)	Left (cm)
15 cm above patella	51	50.5
10 cm above patella	49.5	49
Around patella	46	46
Tibial tuberosity	34.5	34.5
Around calf muscles	41	41
Ankle Joint (around malleolus)	26	26

Table 24: Final length test.

Length (cm)	Right (cm)	Left (cm)
Anatomical Length	83.5	83
Functional length (from ASIS to medial malleolus)	90	91
Functional Length (from umbilicus to medial malleolus)	98.5	98
Length of thigh	39	39
Length of middle leg	37.5	38

3.7.5 Examination of Goniometry

Table 25: Final range of motion of the hip joint.

	Right (degree)	Left (degree)
Active	S:0-0-60; F:25-0-10; R:5-0-15	S:10-0-100; F:30-0-10; R: 20-0-20
Passive	S:10-0-90; F:30-0-15; R:10-0-20	S:15-0-110; F:35-0-15; R:30-0-25

Table 26: Final range of motion of the knee joint.

	Right (degree)	Left (degree)
Active	S:0-0-90	S:0-0-100
Passive	S:0-0-100	S:0-0-120

Table 27: Final range of motion of the Ankle joint.

	Right (degree)	Left (degree)
Active	S:10-0-35; R:20-0-30	S:10-0-40; R:20-0-30
Passive	S:15-0-40; R:30-0-35	S:15-0-45; R:30-0-35

3.7.6 Muscle strength test

Table 28: Final muscle strength test (according to Janda).

Muscle	Right	Left
Quadriceps femoris	4	4+
Biceps Femoris	4	4+
Medial Hamstrings	4	4+
Hip adductors	2+	4
Hip abductors (Tensor fascia late)	2+	4
Iliopsoas	4	4+
Gluteus maximus	2	4+
External rotators (Piriformis)	3+	4+
Gluteus Medius	3+	4
Gluteus Minimums	3+	4
Tibialis anterior	4+	4+
Triceps Surae	4+	4+

3.7.7 Muscle length test

Table 29: Final muscle length test (according to Janda and Kendall).

Muscle	Right	Left
Hamstring	Grade 0 (no shortness)	shortness
Hip flexor one joint	Grade 1 Shortness	Grade 1 shortness
Hip Flexor two joint	Grade 1 shortness	Grade 1 shortness
Hip adductors	Grade 1 shortness	Grade 0 (no shortness)
Gastrocnemius	Grade 0 (no shortness)	Grade 0 (no shortness)
soleus	Grade 0 (no shortness)	Grade 0 (no shortness)

3.7.8 Muscle palpation

Table 30: Final muscle tone palpation

Muscle	Right	Left
Rectus femoris	Normal tone	Normal tone
Vastus medialis	Hypotonic	Hypotonic
Vastus lateralis	Hypertonic	Normal tone
Biceps femoris	Normal tone	Normal tone
Semitendinosus	Normal tone	Normal tone
Semimembranosus	Normal tone	Normal tone
Piriformis	Normal tone	Normal tone
Gluteus maximus	Normal tone	Normal tone
Gluteus Medius	Normal tone	Hypertonic
Hip abductors	Normal tone	Hypertonic
Hip adductors	Normal tone	Normal tone
Triceps surae	Normal tone	Normal tone

3.7.9 Neurological examination

Superficial sensation Examination

Table 31: Final superficial sensation Examination

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

Deep sensation examination on the lower Extremity

Position sense: the patient was in supine position, firstly I hold the big toes of the patient and I showed her the direction of up and down. Then I asked the patient to close her eye then I moved the big toe up and down and the patient was able to know which direction it was. As well as I was changing between toes and the patient was able to know which toe was it and this test was performed in both sides.

Stereognosis: the patient was supine position, I asked the patient to close her eyes, then I gave her a common object (Key). And she was able to recognize it.

Kinesthesia: the patient was in supine position with her eyes closed, then I started to her big toe up and down. And she was able to know when the movement started and stopped. This test was performed on both sides.

Deep tendon reflexes examination

Table :32 Final deep sensation Reflexes examination.

	Right	Left
Knee jerk reflex (L3-L4)	Normal/3	Normal/3
Achilles reflex (L5-S2)	Normal/3	Normal/3
Plantar Reflex	Normal/3	Normal/3

3.7.10 Joint play examination

Table 33: Final joint play examination (According to Lewit).

Joint play	Right	Left
patella	Free	Free
Head of fibula	Free	Free
Talocrural	Free	Free
Subtalar	Free	Free
Lisfranc	Free	Free
Chopart	Free	Free
Metatarsals	Free	Free

3.7.11 Soft tissue examination

Skin

In comparison with the healthy side, there is no visible edema in the operated area (lateral part of the thigh) and no hematoma is present around the scar. And the skin around the scar is normal temperature.

Around the scar (anterior part of thigh, anterior lateral part of thigh and medial part of the thigh), the skin is no longer restricted in all directions in the right side. On the other hand,

the skin of thigh on the healthy side (anterior part of thigh, anterior lateral part of thigh and medial part of the thigh), there is no restriction in all direction.

The scars are free in all parts and in all directions.

Fascia

Table 34: Final fascia examination (According to Lewit).

	Right	Left
Upper anterior part of thigh	No restriction	No restriction
Lower anterior part of thigh	No restriction	No restriction
Posterior part of thigh	No restriction	No restriction
Achilles tendon	No restriction	No restriction

3.8 Conclusion of the final examination

From the final kinesiological examination results, you can see that there is an overall improvement in the patient condition, from circumferences examination in a comparison with the healthy side, there is no visible edema as well as the temperature on the right thigh around the scar (anterior lateral part of thigh, upper and lower anterior part of thigh) is normal; in addition, no hematoma was present on the lateral part of thigh.

From gait examination, we found out that her right knee is slightly still flexed and the right heel still slightly off the ground, she is able to load almost the whole foot except the heel on the operated side and she still tends to load the healthy side slightly more which resulting in limping during the gait.

From ROM examination, with comparison with the healthy side, there is an improvement but still limitation in the range of motion of right hip joint (in the direction of flexion, extension, and external and internal rotation) which is due to recent operation. Furthermore, there is increased strength but still muscle weakness in the operated side compared to the healthy side, which results in muscle imbalance overall the lower extremities.

From palpation of muscle tone, the muscles in both extremities have normal tone except the vastus medialis which was hypotonic in both extremities, the right vastus lateralis which was hypertonic and the left hip abductors which were hypertonic.

All neurological examinations were negative. From the joint play examination, we found out that there is no more restriction, and all joints are free on both lower extremities.

Moreover, from the soft tissue examination, the skin, fascia, and scar are no longer restricted and are free in all parts and in all directions. In conclusion, the overall and functional state of the patient has improved but there are still some factors which need to improve through further physiotherapy.

3.9 Effect and evaluation of therapy

I worked with my patient for two weeks and during this time we saw significant improvements in her overall physical state. In this time, we used a well-structured therapeutic program which included several techniques with different effects to help reach the short-term therapy goals. This included the use of active, active assisted and passive movements every session to improve the range of motion. Further, static stretching and joint mobilizations were also done to improve the patient's range of motion in the hip joint, as shown in table 36, 38 and 40. Strengthening exercises were done progressively as well to improve the active range of motion as well as to improve the general strength and function of the operated lower extremity, as shown in table 37. The patient had a lot of hyper tone in the non-operated extremity and PIR was used to reduce the tonicity of these muscles, as shown in table 39. Soft tissue techniques and scar treatment showed to help improve the mobility of the skin and soft tissue as well as the mobility of the scar, as shown in table 41. Later in the therapy sessions, we started adding stability training to improve the static and dynamic hip stability of the patient. also, soft tissue procedures showed a great reduction in hematoma and swelling, as shown in table 35. Finally, physical therapy was done by hydrotherapy. The patient was made to walk on a treadmill while submerged in water and it allowed her to properly load the affected leg for the first time as well as do the proper gait pattern. In addition to this, gait training was performed to gradually increase the patient's independence and progress from using a 4-wheel walker to eventually only needing crutches.

The technique I liked the most was the hydrotherapy as the patient also enjoyed it and felt happy to be able to load the operated extremity and walk normally for the first time after surgery.

Pilates exercises are a technique used in this case to reduce the risk of fall. However, I did not use this technique as I was not aware of this technique until I did further research during this case study, and I would integrate it into my therapy plans for future patients.

The patient cooperated well with me and was always ready to exercise and follow instructions even if she was tired or felt pain as she wanted to get better soon and improve her condition.

In summary, the therapy was of huge benefit to the patient, and we saw improvements over the course of therapy in the two weeks that I worked with my patient. The effect and results of therapy can be seen below in the comparison tables of the patient's physical state before and after the therapy was done.

Table 35: Circumferences of right leg before and after therapy

Circumference (cm)	Before (cm)	After (cm)
15 cm from knee cup	53	51
10 cm from knee cup	51	49.5
Around knee cup	46	46
Tibial tuberosity	35	34.5
Around calf muscles	41	41
Ankle Joint (around malleolus)	26	26

Table 36: Range of motion of the hip joint before and after.

Plane	Before (degree)	After
Active	S:0-0-30; F:20-0-5; R:5-0-5	S:0-0-60; F:25-0-10; R:5-0-15
Passive	S:5-0-65; F:25-0-10; R:10-0-10	S:10-0-90; F:30-0-15; R: 10-0-20

Table 37: Muscle strength of right leg before and after.

Muscle	Before	After
Quadriceps femoris	3+	4
Biceps Femoris	2+	4
Medial Hamstrings	3+	4
Hip adductors	2	2+
Hip abductors (Tensor fascia late)	2	2+
Iliopsoas	2-	4
Gluteus maximus	2-	2
External rotators (Piriformis)	2+	3+
Gluteus Medius	2+	3+
Gluteus Minimums	2+	3+
Tibialis anterior	4+	4+
Triceps Surae	4+	4+

Table 38: Muscle length of right leg before and after

Muscle	Before	After
Hamstring	Shortness	Grade 0 (no shortness)
Hip flexor one joint	Grade 2 Shortness	Grade 1 Shortness
Hip Flexor two joint	Grade 2 shortness	Grade 1 shortness
Hip adductors	Grade 2	Grade 1 shortness
Gastrocnemius	Grade 0 (no shortness)	Grade 0 (no shortness)
soleus	Grade 1	Grade 0 (no shortness)

Table 39: Muscle tone of right leg before and after

Muscle	Before	After
Rectus femoris	Normal tone	Normal tone
Vastus medialis	Hypotonic	Hypotonic
Vastus lateralis	Hypertonic	Hypertonic
Biceps femoris	Hypotonic	Normal tone
Semitendinosus	Hypotonic	Normal tone
Semimembranosus	Hypotonic	Normal tone
Piriformis	Hypotonic	Normal tone
Gluteus maximus	Hypotonic	Normal tone
Gluteus Medius	Hypotonic	Normal tone
Hip abductors	Hypotonic	Normal tone
Hip adductors	Hypertonic	Normal tone
Triceps surae	Hypertonic	Normal tone

Table 40: Joint mobility of right leg before and after

Joint play	Before	After
patella	Restricted laterally and caudally, free medially and cranially	Free
Head of fibula	Restricted	Free
Talocrural	Restricted	Free
Subtalar	Restricted	Free
Lisfranc	Restricted	Free
Chopart	Restricted	Free
Metatarsals	Free	Free

Table 41: Mobility of fascia of right leg before and after

	Before	After
Upper anterior part of thigh	Restricted	No restriction
Lower anterior part of thigh	Restricted	No restriction
Posterior part of thigh	Slightly restricted	No restriction
Achilles tendon	No restriction	No restriction

3.10. Discussion

During two weeks of therapy with my patient. it was observed that the therapeutic methods were quite effective for progression of the patient condition. After postoperative hip surgery early mobilization and early assisted walking is crucial for patient independence and functional ability which accelerated functional recovery [36].

At FTN, day after the surgery patients are educated on proper bed mobility. Gradually this progresses transfers and assisted walking.

During the initial phase after surgery, one of the main goals is to increase range of motion which is done by active, active assistive and passive movements as well as static stretching [37,38]

At the hospital, the rehabilitation department works with the patient to do these types of movements and help the patients with stretching and joints mobilization. In the department, they have facilities like red cord and continuous passive movement machine (CPM) which are used to increase the range of motion. Furthermore, to improve lower limb function and stability, strengthening exercises significantly helps to improve the strength of hip movements and regain active range of motion of hip joint [39]

At FTN, physiotherapists provide variety of strengthening exercises including isometric, concentric and eccentric contraction to achieve this goal. Hospitals is equipped with many materials such as TheraBand, overball. big ball and stationary cycling. Next, using different types of physical therapy modalities like cryotherapy and TENS which is used to reduce inflammation and postoperative pain [40,13]

In the acute stage after the surgery, at FTN the patient is provided with icepacks, and they are recommended to use from 10 to 15 minutes twice or three times a day. Also, in some cases they apply electrotherapy in the form of TENS.

Additionally, a recent study shows integrating Pilates exercises with the standard therapy plan have a great effect to reduce future risk falls especially with post status hip fracture. [38]

This technique is not used at FTN however it would be beneficial for the patients if it would be integrated in the therapy plans.

Sens motoric stimulation training play a vital role increasing proprioception as well as stability which also helps with minimizing the risk of fall [44].

At the rehabilitation department, they supply lots of therapeutical aids such as big ball, balance pads, soft pads, etc. which are commonly used gradually as the patient progresses with therapy. Finally, in the advanced stages, PNF is used to improve motor function and range of motion [45].

This method is often used by therapists in the rehabilitation department for both strengthening and relaxation effect.

Overall, it was observed that the patient's subjective and objective condition has improved using the above-mentioned technique which was used by me. The patient was quite happy and satisfied with therapy plan as she could feel regular improvement. During working with my patient, one method that could have been used to reduce hematoma and edema is vacuum therapy. This could have increased the rate of hematoma and edema reduction.

4. Conclusion

The purpose of this study to demonstrate physiotherapeutic treatment for a patient after fracture of proximal right femur. My thesis is divided into two main parts. First part, which is theoretical, speaks about the hip joint's characteristics, biomechanics, kinesiology, classification of fractures, causes and prevention methods and types of treatments which includes surgical and non-surgical treatment. The practical part demonstrates the physiotherapeutic methods used in the treatment of patient following surgery after fracture of proximal right femur. This case study gave me the opportunity to apply my theoretical and practical knowledge on hospital setting and it gave me a better understanding of the hip joint and injuries which is related to it. This would be advantageous for me in my future work as physiotherapist as the hip one of the most important structures of the body and injuries of the hip can affect the whole body especially related to elderly people as they have higher rates of falls. Furthermore, this study helped me get a better overview of the healing process related to surgery after hip fractures.

The patient was fully cooperative and determined to recover and enhance her condition this was beneficial for me and the patient as we were able to see regular improvement related to goals of therapy.

In conclusion, I was able to accomplish the goals of this case study. By applying my theoretical and practical knowledge to demonstrate the effect of different physiotherapeutic methods on a patient after hip fractures.

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6. Supplementets

6.1. Ethical Board

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

Application for Approval by UK FTVS Ethics Committee

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

The title of a project: Case study of physiotherapy treatment of a patient after a pertrochanteric fracture of the right femur

Project form: Bachelor thesis

Period of realization of the project: January 2023 – February 2023

The research will be carried out in accordance with the valid epidemiological measures of the Ministry of Health of the Czech Republic.

Applicant: Asem Mohamed Abdelgawad, UK FTVS Department of Physiotherapy

Main researcher: Asem Mohamed Abdelgawad, UK FTVS Department of Physiotherapy

Place of work: Klinika Revmatologie a rehabilitace 3. LF UK / Fakultní Thomayerova nemocnice

Supervisor (in case of student's work): Mgr. Katerina Marsakova

Financial support: -

Project description: Case study of physiotherapy treatment of a 73 years old patient after a pertrochanteric fracture of the right femur. The goal of this study is to record and evaluate the effectiveness of the physiotherapy treatment that will be provided to the patient.

Characteristics of participants in research: The participant is a 73 years old Female patient who has been assigned to me at Klinika Revmatologie a rehabilitace 3. LF UK / FTN for my Bachelor Thesis. Patients with acute (especially infectious) diseases do not participate in therapy.

Ensuring safety within the research: The therapy I plan to use does not include any invasive methods and the patient will not be put at any risk. The therapy will not have any harmful effect on the patient's health and all therapy done by me will be done in the presence of my supervisor Bc. Vaclav Marek. Risks of therapy and methods will not be higher than the commonly anticipated risks for this type of therapy.

Ethical aspects of the research: Data will be collected in line with the rules given by European Union no. 2016/679 and the Czech Act no. 110/2019 Coll. – on personal data processing.

The collected data will be anonymized within one week after the end of working with the patient. I understand that anonymization means that the text does not use any item of information or combination of items that could lead to the identification of a person. I will be careful not to enable recognition of a person in the text of the thesis, especially within the anamnesis. After the text has been anonymized, any personal data still kept elsewhere will be deleted.

All collected data will be safely stored on a PC safeguarded by a keyword in a locked room, any data in paper form will be kept safely under lock and key in a locked room. The data will be processed, safely retained and published in an anonymous way in the bachelor thesis.

Photographs: Photographs of the participant will be anonymized within one week after being taken by blurring the face, parts of the body or any characteristics that could lead to identification of the person. After anonymization any non-anonymized photographs will be deleted. The non-anonymized photographs will be accessed only by the main researcher and supervisor.

No audio recordings or video recordings will be taken during the research.

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

Informed Consent: attached

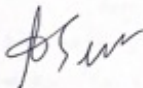
It is a duty of all participants of the research team to protect life, health, dignity, integrity, the right to self-determination, privacy and protection of the personal data of all research subjects, and to undertake all possible precautions. Responsibility for the protection of all research subjects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

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

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, 24.01.2023

Applicant's signature:



Approval of UK FTVS Ethics Committee

The Committee: Chair: Doc. PhDr. Irena Parry Martínková, Ph.D.

Members: Prof. PhDr. Pavel Šlepička, DrSc.

PhDr. Pavel Hráský, Ph.D.

Mgr. Tomáš Ruda, Ph.D.

Prof. MUDr. Jan Heller, CSc.

Mgr. Eva Prokešová, Ph.D.

MUDr. Simona Majorová

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

044/2023


Date of approval:

24.1.2023

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
- 20 -


Signature of the Chair of
UK FTVS Ethics Committee

6.2. 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 1

....., 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 2

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 3

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.

88

Místo, datum

Jméno a příjmení pacienta Podpis

pacienta:

Jméno a příjmení zákonného zástupce 4

Vztah zákonného zástupce k pacientovi

Podpis:

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Table 29: Final Muscle length test (according to kendall and Janda)

Table 30: Final Muscle tone palpation

- Table 31: Final Superficial sensation Examination
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6.5. List of abbreviations

1. FTN – Fakultní Thomayerova Nemocnice
2. PFFs – Fractures of the proximal femur
3. ITB – Iliotibial band
4. ROM – Range of Motion
5. BMI – Body Mass Index
6. hGH – Human growth hormone
7. AO/OTA – Orthopedic Trauma Association
8. DHS – Dynamic hip screws
9. DM – Diabetes Mellitus
10. HTN – Hypertension
11. TENS – Transcutaneous Electrical Nerve Stimulation
12. PNF – Proprioceptive Neuromuscular Facilitation
13. ASIS – Anterior Superior Iliac Spine
14. PSIS – Posterior Superior Iliac Spine
15. PIR – Post Isometric Relaxation
16. CPM – Continuous Passive Movement