

**Case Study of Physiotherapy Treatment of a Patient with the Diagnosis
of Total Hip Replacement**

BACHELOR DEGREE PROGRAM IN PHYSIOTHERAPY

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I would like to thank my parents who were supporting me and always standing by me. Also I would like to thank my supervisors for the help and supervision during the realization of this work and my adviser during the ten days practice in Fakultni Nemocnice Kralovske Vinohrady. Many thanks to all teachers of our faculty who educated me.

Abstract

The abstract of my study concerns the treatment of the case of my patient who had an operation of total hip replacement on the right hip joint, caused by post dysplastic arthrosis. My practice was performed at Fakultni Nemocnice Kralovske Vinohrady. Physiotherapy program started on Tuesday 29th of January 2013 and ended on Friday 1st of February 2013.

My Bachelor Thesis is divided in two parts: 1) Theoretical part 2) Practical part.

In the theoretical part I analyse everything concerning the hip joint, muscles, joints, bones, ligaments, nerves as well as the biomechanical and kinesiological point of view of the hip joint. In the practical part I analyse every procedure I have done with my patient, all the examinations, conclusions, therapies and results.

The patient was operated at OTK FNKV hospital at 22nd of January.

Goals of the therapy was to decrease pain and edema, increase range of motion of the movement, increase mobility and elasticity of skin and also improve strength of the operated right hip according to the examinations I provided to the practical part.

After the five sessions improvements were detected in the final kinesiological examination. Pain was decreased to 3/10 according to VAS scale, edema was reduced, range of motion (ROM) of the movements and muscle strength were also improved, as well as the mobility and elasticity of skin and fascias of the right hip. The results of the

final examinations showed that the stability of the patient in walking with crutches was improved.

Declaration

I declare that this Bachelor Thesis I wrote it by myself on my own practice that took place in Facultni Nemocnice Kralovske Vinohrady in Prague from 21/01/2013 till 01/02/2013 with the help of the sources which I refer to in the list of literature that exists in the end of this Thesis.

I also declare that no invasive methods were used during my clinical practice in and that the patient was fully aware of the examinations and therapeutic procedures at any time. My practice was under supervision of my supervisors Mgr. Pavla Kratochvilova, Mgr. Miroslava Jalovcova (as she was my first supervisor) and by Mgr. Helena Vomackova in Department of Physiotherapy, in Faculty of Physical Education and Sport of Charles University in Prague.

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1. INTRODUCTION

My physiotherapy program took place at Fakultni Nemocnice Kralovske Vinohrady in Prague from 21/01/2013 until 01/02/2013.

The following thesis is about after Total Hip Replacement caused by post dysplastic arthrosis. I have chosen to do this subject for my bachelor thesis because this kind of operation is quite often done in the elderly people and I wanted to have more knowledge and experience about it.

By this thesis my aim was to explain generally about the total hip joint replacement and more specific about the rehabilitation which should be followed for a quick recovery of the patient.

Goals of the therapy were to decrease pain at hip joint and edema around the scar, increase range of motion in hip and knee joint, and strength of the operated right hip.

For the theoretical part of this case study, I analyzed the anatomy of the hip as well as the biomechanical and kinesiological point of view of the hip joint. Reader will also find information about examinations of the patient as well as the physiotherapeutic sessions that took place during my practice.

For the practical part I have analyzed all the possible available information about the patient's anamnesis, previous rehabilitation, physicians prescribe, indication of rehabilitation, initial kinesiology examination, short-term and long-term rehabilitation plan, therapy progress, final kinesiology examination, conclusion of examination and evaluation of the effect of the therapy.

2. GENERAL PART

2.1 Anatomy of the hip joint

The hip joint is the articulation between the head of the femur and the acetabulum of the innominate bone.

It is a synovial ball and socket joint and permits a wide range of movements compatible with a wide range of locomotor activities.

The hip joint connects the lower limb to the trunk and therefore is involved in the transmission of weight.

The mechanical requirements of the joint are severe. It must be capable not merely of supporting the entire weight of the body, as in standing on one leg, but of stable transference of the weight, particularly during movement of the trunk on the femur, as occurs during walking and running. (9)

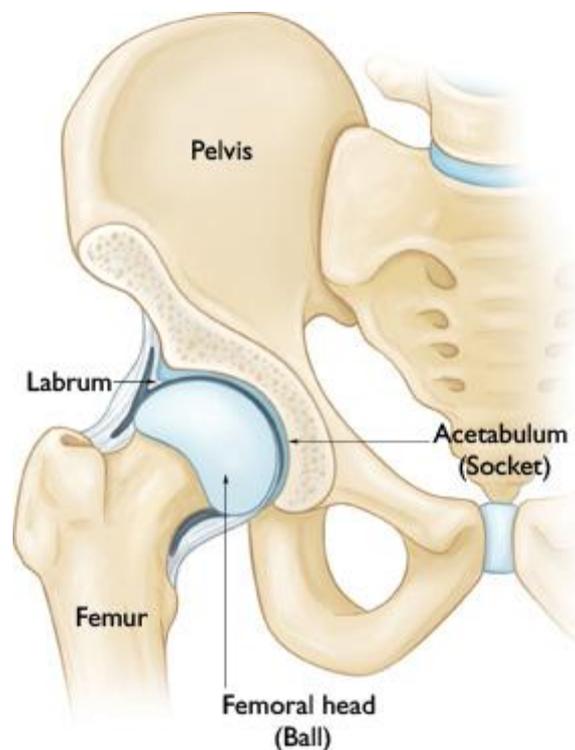
2.1.1 *Articular surfaces*

Acetabulum

The acetabulum is a hemispherical hollow on the outer surface of the innominate, formed by the fusion of its three component parts: the ilium, ischium and pubis which meet at a Y-shaped cartilage forming their epiphyseal junction. The anterior one-fifth of the acetabulum is formed by the pubis, the superior posterior two fifths by the body of the ilium and the inferior posterior two fifths by the ischium. The prominent rim of the acetabulum is deficient inferiorly as the acetabular notch. The heavy wall of the acetabulum consists of a semilunar articular part, covered with hyaline cartilage, which is open below, and a deep central non-articular part, the acetabular fossa. The acetabular fossa is formed mainly from the ischium and its wall is frequently thin. (9)

Head of femur

The head of the femur forms approximately two-thirds of a sphere, being slightly compressed in an anteroposterior direction. The head is covered in articular (hyaline) cartilage, except for a small area superolaterally adjacent to the neck and at the fovea capitis, a pit on the posteromedial part of the head. Anteriorly the cartilage extends on to the femoral neck for a short distance. This is thought to be a reaction to the pressure from the iliopsoas tendon crossing the joint in this region. Both the femoral head and the acetabulum are composed of cancellous bone covered by a thin layer of compact bone. (9)



Picture 1 - Anatomy of the hip joint (27)

2.1.2 Capsular ligaments

Iliofemoral ligament is very strong and thick and is located anterior to the joint. It is often referred to as being Y-shaped with the stem corresponding to the apex and the two limbs to the base. Pubofemoral ligament passes from the iliopubic eminence and

obturator crest to the capsule on the inferior part of the neck of the femur. Strengthens the inferior and anterior aspects of the joint capsule. Ischiofemoral ligament is the weakest. Is spiral in shape and it arises from the body of the ischium behind and below the acetabulum. (7, 9)



Picture 2 - Hip joint ligaments (28)

2.1.3 Muscles of the hip

Some of the hip joint muscles are responsible for more than one type of movement, as different areas of the muscle act on tendons in different ways. There are six groups of muscles: flexors, extensors, lateral and medial rotators, abductors and adductors.

Gluteal muscles: gluteus maximus, medius and minimus are attached to the posterior surface of the pelvis (ilium). Gluteus medius and minimus travel laterally to insert into the greater trochanter of femur and gluteus maximus into iliotibial tract and gluteal tuberosity. Medius and minimus abduct and medially rotate the hip joint and stabilize the pelvis. Gluteus maximus extends and laterally rotates the hip joint.

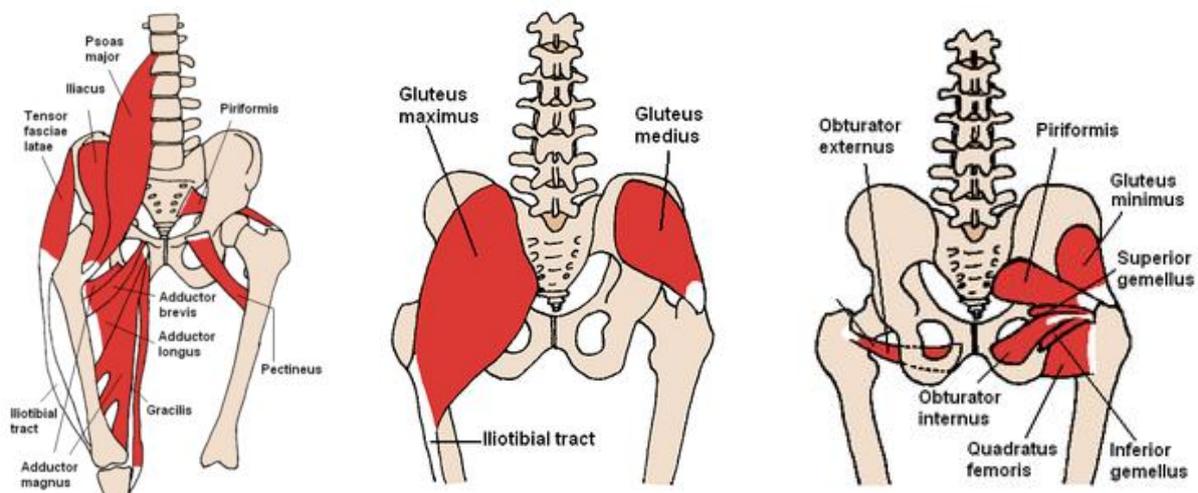
Quadriceps muscles: vastus medialis, lateralis, intermedius and rectus femoris are attached inferiorly to the tibial tuberosity of the shin. Rectus femoris m. originates at the anterior inferior iliac spine, inserts into the patella and tibial tuberosity and flexes the knee and

hip. Vastus medialis m. originates at the medial linea aspera, insert to patella and extends the leg. Vastus lateralis m. originates at lateral linea aspera, insert to patella and extends and stabilize knee. Vastus intermedialis m. originates at the shaft of femur, insert to rectus femoris tendon and extends the knee joint.

Iliopsoas muscle: is the primary hip flexor, cross the hip joint and insert to the lesser trochanter of femur.

Hamstrings muscles: biceps femoris (short and long head), semitendinosus, semimembranosus. Biceps femoris: short head originates at linea aspera and long head at ischial tuberosity, both are inserted to fibular head and flexes and laterally rotate knee joint. Semitendinosus m. and semimembranosus m. originates to ischial tuberosity. Semitendinosus insert to medial surface of tibia and semimembranosus to medial condyle of tibia. Both are flexes knee joint and extend hip joint.

Adductor muscles: adductor magnus, brevis and longus, pectineus and gracilis. Are also called groin muscles and their action is hip adduction. (8)



Picture 3 - Muscles of the hip (29)

2.1.4 Blood and nerve supply of the hip joint

The hip joint receives its blood supply from the medial and lateral circumflex femoral arteries, the obturator artery and the superior and inferior gluteal arteries, which together form a periarticular anastomosis. The adequacy of the periarticular arterial anastomosis is important for the nutrition of the bone, particularly for the proximal femoral epiphysis until ossification is completed, which is usually between 16 and 20 years. Similarly, following a fracture, healing of the bone requires a good blood supply. (9)

The three nerves of the pelvic girdle and lower limb supply the hip joint. The femoral nerve through the nerve to rectus femoris, the sciatic through the nerve to quadratus femoris and the obturator nerve directly from its anterior division. All innervate the capsule and the retinacular fibers. (7)

2.1.5 Biomechanics of the hip joint

The estimation of hip joint forces during simple activities has a long history and is being refined with the use of measuring techniques and the advent of powerful microcomputers. Studies are still limited to determining joint forces during walking.

The load across the hip is a result of the patient's weight acting downwards and muscles pulling the femur medially and upwards at an angle of about 1 degree from the vertical.

When standing on one leg the abductors act at a mechanical disadvantage because they are nearer the centre of the hip joint than the patient's centre of gravity (L1). They have to lift about 3 times body weight and the load across the hip is increased.

When loading a diseased hip is painful it is useful to reduce the load across the hip by allowing the abductor muscles to work at a greater advantage.

With estimates of hip joint forces in normal subjects ranging up to 6 times body weight the trabeculae within the acetabulum and the head and neck of femur must be arranged to minimize bending and shearing stresses within the bone. (2, 9)

2.1.6 Hip joint movements

The hip joint can provide flexion and extension, abduction and adduction, medial and lateral rotation and circumduction.

Flexion and extension: The degree of flexion and extension depends on the position of the knee. If the knee is flexed relaxing the hamstrings the thigh can be moved toward the anterior abdominal wall. The muscles responsible for flexion are psoas major and iliacus and assisted by rectus femoris, tensor fasciae latae, sartorius and pectineus. Extension occurs as the thigh swings posteriorly by gluteus maximus at the extremes of the movement and by the hamstrings in the intermediate stage. Is not normally possible above 30 degrees.

Abduction and adduction: Abduction and adduction of the hip joint, some 45 degrees each, are free in all positions of the lower limb, except for adduction in the anatomical position.

Rotation: Rotation of the hip can be carried through approximately one-sixth of a circle when the thigh is extended and more when it is flexed. Lateral rotation is much more powerful than medial rotation.

Circumduction: Is a combination of all movements. (3, 7)



Picture 4 - Hip joint movements (30)

ACTION	MUSCLES	NERVE	SEGMENTS
Flexion-Initiate	Tensor fascia lata	Superior gluteal	L 4, 5, S 1
	Pectineus	Femoral; Obturator	L 2, 3, 4
	Sartorius	Femoral	L 2, 3, 4
	Gracilis	Obturator	L 2, 3, 4
Flexion-Complete	Iliopsoas	Lumbar plexus	L 1, 2
Extension	Gluteus maximus	Inferior gluteal	L 5, S 1, 2
	Hamstrings	Sciatic	L 5, S 1, 2
	Add. magnus - post.	Sciatic	L 3, 4
Adduction	Adductors longus	Obturator	L 2, 3, 4
	Adductors brevis	Obturator	L 2, 3, 4
	Adductors magnus	Obturator	L 2, 3, 4
	Gracilis	Obturator	L 2, 3, 4
Abduction	Gluteus medius	Superior gluteal	L 4, 5, S 1
	Gluteus minimus	Superior gluteal	L 4, 5, S 1
Inward Rotation	Gluteus minimus	Superior gluteal	L 4, 5, S 1
	Tensor fascia lata	Superior gluteal	L 4, 5, S 1
Outward Rotation	Gluteus maximus	Inferior gluteal	L 5, S 1, 2
	Piriformis	Nerve to piriformis	S 1, 2
	Obturator externus	Obturator nerve	L 3, 4
	Obturator internus	Nerve to obturator internus	L 5, S 1, 2
	Gemellus superior	Nerve to obturator internus	L 5, S 1, 2
	Gemellus inferior	Nerve to inferior gemellus	L 4, 5, S 1
	Quadratus femoris	Nerve to inferior gemellus	L 4, 5, S 1
	Gluteus medius	Superior gluteal	L 4, 5, S 1

Table 1 – Prime movers of the hip joint (Gross Anatomy) (18)

2.2 Post dysplastic arthrosis

Hip dysplasia is a condition in which the hip joint becomes unstable because the bones and supportive soft tissues (joint capsule, ligaments) of the hip have developed or grown abnormally in utero. With hip dysplasia the hip socket (acetabulum) usually is shallow and does not hold the ball (femoral head) securely and the femur may be abnormally twisted causing increased forces at the hip joint. Over time, associated looseness (laxity) of support ligaments and pulling of hip muscles allows increased movement of the femoral head within the acetabulum resulting in abnormal forces on the joint surfaces that cause joint instability, degeneration and chronic pain.

With hip dysplasia the surfaces of the hip joint (the femoral head and the acetabulum) may experience incomplete contact (subluxation) or a total loss of joint contact (dislocation). The severity of hip dysplasia is rated according to the extent of contact between the femoral head and the acetabulum and signs of osteoarthritis as viewed on x-ray. Although hip dysplasia is typically first recognized in infants, mild hip dysplasia may not be diagnosed until adulthood. Is a common cause of hip pain in young adults and if is not treated can lead to early degenerative changes (osteoarthritis) of the hip joint. Hip dysplasia is a cause of degenerative changes in the hip leading to hip replacement surgery in adults.

Another type of hip dysplasia is the developmental dysplasia of the hip (DDH) or it is also known as congenital dislocation of the hip (CDH). If is not diagnosed and treated within the first months of life will be a serious condition. Girls are affected more than boys and the left hip is affected more often than the right hip. One-third of dislocated hips have an abnormality of the opposite hip. (2, 15)

2.2.1 Clinical picture

The first sign of hip dysplasia is typically hip pain. In rare cases, clicking and popping may be the presenting sign.

Hip pain from dysplasia is usually associated with activities. Pain deep in the front of the groin is the most common and pain in the side or back of the hip is also frequent. When symptoms first occur they may be only occasional and mild. Over time there may be an increase in the frequency and intensity of the pain.

Once symptoms of dysplasia become more severe, a mild limp may occur. The most cause of a limp is pain. A painless limp may be caused by weak muscles, limited flexibility of the hip joint or bone deformity. (17)

2.2.2 Diagnosis

Hip dysplasia diagnosed by a complete medical history, a physical examination and an X-ray evaluation. For accurate diagnosis other types of imaging, such as a magnetic resonance arthrogram (MRA) or a computed tomography (CT) scan are required. (16)

2.3 Treatment

2.3.1 *Conservative treatment*

Non-surgical treatment may be chosen in very mild dysplasia with mild symptoms or when the hip is too arthritic for surgery.

For these patients anti-inflammatory medication, weight loss, lifestyle modification, steroid injections and specific physical therapy may help to decrease pain and relieve symptoms. (14)

2.3.2 Non-conservative treatment

Patients with hip dysplasia who experience pain and have limited damage to their cartilage may be leads for periacetabular osteotomy (PAO). A series of cuts is performed to the bone to reorient the acetabulum over the femoral head to restore normal alignment. Then screws are placed in the bones to stabilize this position.

In up to 10% of patients the orthopaedic surgeon may also perform a femoral osteotomy.

Joint replacement surgery (arthroplasty) uses artificial parts to replace the damaged joint. The two main categories of hip replacement are hip resurfacing and traditional total hip replacements. (10)

2.4 Examination

2.4.1 Physiotherapist's examination (in stage after total hip replacement)

Anamnesis-history

In hip dysplasia even if the diagnosis is clear the history will give important information about the problem. Physiotherapist asks when the first symptoms appeared and how, what kind of symptoms and in which scale, which movements worsen the pain and which decrease it. If the state of patient engages his ADL and makes it more difficult for him/her and ergonomics. Ask about any occupational risks and sports activities.

Personal anamnesis also includes questions for chief complain (if pain is present, fever, hypertension etc), past rehabilitation, previous injuries and accidents, also previous surgeries, gynecological anamnesis (if she is a woman) if any complications with the menstrual cycle, allergies and abuses. Also physiotherapist asks

about family history if there is any similar situation and past medical history that may give important information for the treatment plan and prognosis. (4)

Observation

The examiner must observe the hip (edema, scar, stitches) and must not forget to observe the whole body.

Muscle tone examination (palpation)

Palpation is essential, both for diagnosis of painful changes in the tissues in general and in the locomotor system in particular and also for all manipulative techniques. The first step for the physiotherapist in palpation, after touching surface of the patient's body is to concentrate to his/her goal: testing resistance, mobility, shape, temperature, moisture and roughness or provoking pain.

By palpation examination physiotherapist checks for kind of edema, tone of the muscles (hypertonus or hypotonus), reflex changes, infection of the skin , trigger point, tender point and fascia of the muscles (how fascia is movable or not). The normal response of muscle to any form of stress is to increase in tone: atonus, hypotonus, normal tonus, hypertonus.

For stage after total hip replacement therapist is able to check the tone of the muscles, thigh muscles (m. quadriceps femoris and hamstrings), hip flexors, abductors and adductors of the hip, m. quadratus lumborum, hip extensors and abdominal muscles. (26)

Posture examination

Evaluation of anterior, posterior and side view of the patient in erect standing position is necessary, in order to take information for patient's posture. Posture

evaluation will give us information about the positions of the various joints and body segments, muscle balance or imbalance associated with static postural positions. (20)

Gait examination

Gait examination provides us with the objective qualitative information about normal and disturbed pathological motoric function. Gait is evaluated by having the patient walk across the room under observation.

Also present will be asymmetry of the length, small steps and short, slow rhythm and velocity, no upper extremities and trunk synkinesis, pelvis movement – side deviation, quality of toe off, heel off, heel strike phase will be disturbed due to the muscle weakness.

Pathological types of walking: Unstable walking indicates weakness of m. gluteus medius, walking with shorter lower extremity, antalgic walking in which stance phase is shortened. (21)

Anthropometric measurements

It is the measurement of the height, the length and the circumference on various places on the human body.

This examination is done in order to compare both sides of the body or to use these.

For the length of legs we have to provide two measurements. One measurement about the anatomical length and one about the functional length of legs. The anatomical length is measured from the lateral malleolus to trochanter major and the functional length from medial malleolus to spina iliaca anterior superior.

The circumference of thigh is measured 15 cm above the knee cup and the circumference of calf is measured in the place of the highest volume of the muscle. (22)

Range of motion (ROM)

The term range of motion refers to the amount of motion available in a joint. Range of motion is a function of joint morphology, capsule, ligaments, muscles and

tendons that cross the joint. Physiological range of motion varies a lot because the quality of the ligaments is highly individual and depends on the age, gender and race. Passive range of motion refers to the amount of motion attained passively. Normally passive movement is slightly greater than active because each joint has a small amount of motion which is not under voluntary control as a protective mechanism. Active range of motion refers to the amount of motion attained actively. In case of disability as muscle weakness passive and active ROM varies considerable.

ROM classification: limited (hypomobility), physiological or excessive (hypermobility). Hypomobility or hypermobility affects a subject's functions in activities of daily living.

For evaluation of ROM physiotherapist uses the goniometer. He/she determines either the partial position of the joint (abnormal fixed position) or total amount of motion existing in the joint under certain circumstances.

For the state after total hip replacement physiotherapist is able to provide measurement of ROM in hip joints (flexion-extension, abduction, internal rotation), knee joints (flexion-extension) but also ankle joints (dorsal-plantar flexion). If patient uses crutches it is important to provide ROM evaluation in wrist joints (flexion-extension, ulnar-radial deviation) too. (23)

Muscle strength test

Muscle strength is a term used for the physical force exerted by a muscle which is realized by isometric, concentric or eccentric muscle contractions. Muscle strength may be influenced by: number of muscle fibers involved in the contraction, the degree of muscle length, gender, age, specific loading of the muscle to the person's work or activity.

The grading physiotherapist uses to evaluate the muscle strength according to Kendall:

Grade fair (3): the grade fair indicates that muscle can hold the tested part in given test position against gravity but cannot hold it if even slight pressure is applied. Physiotherapist starts with testing this grade. If position is held then physiotherapist

applies pressure to grade above fair and if the muscle fails to hold the test position we start testing below the grade fair.

Grade below fair (0,1,2)

The grade zero (0) means no contraction on the muscle is felt.

Grade trace (1) means that a feeble contraction can be felt in a muscle or tendon becomes prominent but there is not visible movement.

Grade poor (2) is determined by either test movement in the same antigravity position as grade fair or for more detailed grading in horizontal position . When the first possibility is used physiotherapist expresses the muscle strength as poor if the tested part is able to move through partial ROM.

Grades above fair (4,5)

Grade good (4) refers to ability of the muscle to hold the test position against moderate pressure and

Grade normal (5) refers to ability of the muscle to hold the test position against strong pressure.

For stage after total hip replacement physiotherapist will be able to evaluate the strength of muscle around, thigh, middle leg, and trunk but also around shoulder joint arm and forearm because it is important to estimate whether there enough strength on upper extremities also to use the crutches. (24)

Soft tissue examination

Dysfunctions in our body can increase the tension in various structures (tissues) of the motor system and this tension relates to pain. The main tool in diagnosis of changes in tension of tissues is palpation. Palpation is an application of the fingers on the body surface and investigating about changes in temperature, resistance to pressure, moisture, smoothness or roughness of skin and tissue mobility. After the surgery we can

provide soft tissue examination (skin, subskin and fasciae of the muscle) anterior-posterior of thighs, calves, lower back. (Kibler's fold etc.)

Tension might be created also artificially like the case of a scar presence. After healing and removal of the stitches from the scar we can start the treatment for the tension which is created at that place. With the tips of fingers we massage softly the area around the scar. Then we can palpate the barrier of the scar and we spring it in every direction. Also slight pressure can be applied directly on the scar for better healing. If there is tension in muscles or trigger points we can relax them by post isometric relaxation. First step is to engage the barrier by lengthening the muscle to the point at which the first, slight resistance is met. After this point however, the patient is told to exert slight resistance in the opposite direction, holding it isometrically for about 10 seconds, followed by the order to relax (let go). After few seconds release takes place and the muscle lengthens (decontracts) for anything from a few seconds to half a minute. (5, 6)

Joint play examination

Joint play is a translatory movement in a joint which cannot be performed actively but passively. Joint play is present in each joint on our body and when it is absent there is dysfunction of the functional movement. The joint play is possible to be examined to any joint.

Basic principles of joint play evaluation: the patient has to be relaxed. Not only the extremity but the whole body, the therapist position must be stable but his hand has to be also relaxed, the examined joint must not be locked. Must be in neutral position, the manual contact should be as close as possible to the joint's slit, the proximal part is fixed and the distal is moved, the manual contact must not be painful for the patient, the manual contact must be in the direction of the examined movement, we always use the minimal force which is needed, the examination starts with slight distraction and is followed by a translatory movement always performed in one direction, we never do the movement from one position to the other. We must return in the neutral position always.

Contraindications: fever, acute inflammation, tumours, fracture, ankylosis, acute injures, progressive polyarthritis, swollen joint, painful joint.

In stage after total hip replacement physiotherapist is able to provide joint play examination for the patient who uses also crutches, in: talocrural joint (in dorsal direction), knee joint (in dorsal, ventral and lateral directions), head of fibula (in ventral and dorsal direction), patella (in laterolateral, cranial and caudal directions). (19)

Neurological examination

Neurological examination of the lower extremities involves examining of the different myotomes, dermatomes and deep tendon reflexes. By this examination therapist can diagnose if there is a peripheral nerve compression or lesion. These tests should be carried out whenever the therapist suspects the nervous system to be a source of symptoms. A reduction of motor impulses along a nerve, a reduction of the sensory input and a reduction in the deep tendon reflexes indicates a peripheral nerve lesion or compression.

Subjective light touch: Therapist uses his/her fingers to touch the skin of the patient lightly on both sides simultaneously. He/she tests several areas on both the upper and lower extremities.

Dermatomes examination: therapist uses a suitable sharp object to test “sharp” or “dull” sensation. He/she tests the front of the thighs (L1, 2, 3), medial and lateral aspect of both calves (L4 and L5) and little toes (S1, 2). (25)

2.5 Total hip replacement

A hip replacement may be partial or total. In a partial replacement only the head of femur is replaced. When the entire joint is damaged, a total joint replacement is done. To replace a total hip joint, a surgeon removes the diseased or damaged parts and inserts artificial parts, called prostheses or implants.

The surgery is performed using general or spinal anesthesia. The orthopedic surgeon makes an incision along the affected hip joint over the buttock or from the side, or from the anterior side exposing the hip joint. The head of the femur and the cup are

cut out and removed. Then, the hip socket is cleaned out and a tool called a reamer removes all of the remaining cartilage and arthritic bone.

Then a metal ball and the metal stem are inserted in the femur and a plastic socket is placed in the enlarged pelvis cup. The artificial components are fixed in place with special cement which is made from a type of polymer. The cement is prepared during operation by mixing a liquid which contains the monomer (monomethylmethacrylate) and a stabilizer to prevent it polymerizing, with a powder that includes a catalyst to initiate polymerization and sometimes an antibiotic. The mixture forms a dough-like material which can be forced in the medullary cavity around the implant, where it sets solid. If no cement is used, the joint components are specially made to either press into the bone for a tight fit (press-fit) or to allow new bone to grow into the porous surface of the implant, holding it in place (biological fixation). The muscles and tendons are then replaced against the bones, then a small drainage tube will be placed to help drain excess fluids from the joint area and then the incision is closed. (2, 10)



Picture 5 - Diseased hip joint before and after total hip joint replacement (31)

Possible complications of surgery

Certain additional complications related to joint replacement surgery include: bleeding problems, blood clots in the legs and/or lungs, wound healing problems, damage to nerves and blood vessels, limb length discrepancy, bone erosion or abnormal

bone formation, dislocation, infection, pain, bone fracture or non-union, component wear or fracture, component loosening. Complications may require medical intervention including additional surgery and in rare instances may lead to death. (13)

2.5.1 Pre-operative physiotherapy

The patient has to follow a pre-operative care that includes condition exercises to maintain blood circulation in the lower limbs and to improve cardiorespiratory system, instructions to moving on bed without straining the operation site and to get in and out of bed, exercises to maintain co-ordination and power of the quadriceps, hip abductors and hamstrings. These are encouraged to ensure the patient is as fit as possible for surgery. Lessons on how to walk with crutches is also required. Proprioceptive and sensory motor learning according to Janda to facilitate the proprioceptive system by “short/small“ foot and balance exercises on wobble and rocker boards. (6, 11)

2.5.2 Postoperative physiotherapy

In the immediate postoperative period the hip is positioned in abduction. We use a triangular pillow to maintain abduction and prevent adduction.

Most patients are comfortable and alert enough to begin bed exercises and limited mobilization on the first postoperative day. Deep breathing, ankle pumps, isometric exercises for quadriceps and gluteal muscles are begun. Patients are instructed to exercise for a few minutes each hour. Drains usually are removed 24 to 48 hours after surgery depends on the hospital and the patient’s condition.

On the first or second postoperative day, the patient can sit on the side of the bed or in a chair in a semi supine position for half-hour. One or two pillows in the seat of the chair helps prevent excessive flexion and a pillow between the thighs limits adduction and internal rotation.

Gait training usually can begin on the first postoperative day. Most elderly patients require a walker for balance and stability, younger patients require axillary crutches. The amount of weight bearing allowed on the operated limb depends on the means of fixation of the components, the presence of structural bone grafts, stress risers in the femur and trochanteric osteotomy.

Hip extension exercises are allowed especially if there has been a pre existing flexion deformity. The patient consults to lying in supine position with pillows under knees. The hip flexors can be stretched early by flexing the opposite hip and maintaining the operated limb flat on the bed. After a few days, prone exercises can be initiated. The patient rolls over the unoperated side with a pillow between the legs. After the stitches are removed the care of the scar can start by soft tissue techniques.

Patients who live alone can return to independent living sooner if they are able to dress, put on shoes, pick up objects from the floor and carry out other activities of daily living in a safe manner.

The patient may withdraw from the hospital when is able to get in and out of bed independently, walk over level surfaces and climb a few steps. Instructions for the home exercise program and precautions to prevent dislocation are helpful.

For the first 6 weeks after the operation patients are instructed to use an elevated toilet seat and to use pillows between the knees when lying on the unoperated side. Showering is allowed when wound healing is satisfactory.

Approximately 6 weeks after surgery the patient visits the outpatient clinic for radiographs. If the procedure was an uncomplicated arthroplasty the patient is instructed to using a cane instead of crutches with full weight bearing. Strengthening exercises for the abductor muscles are necessary to eliminate limp and stretching exercises are continued until the patient is able to reach the foot for dressing and nail care.

Many patients with sedentary occupations can return to work after 6 to 8 weeks. Patients can return to occupations requiring limited lifting and bending at 3 months.

Limited athletic activity is allowed such as swimming. Patients should avoid activities requiring repetitive impact loading because are increases the risk of failure of the arthroplasty.

The patient visits doctor at 3 months, 6 months and 1 year and after periodically. Routine radiographs are made at 1 to 2 year intervals and compared with previous films for signs of loosening, migration, wear and implant failure. (1)

3. SPECIAL PART (CASE STUDY)

3.1 Methodology

The clinical work practice was done in Fakultni Nemocnice Kralovske Vinohrady, Prague. It was started on Monday 21st of January 2013 and finished on Friday 1st of February 2013 (10 days). Each day had the duration of 8 hours. The total amount of the hours of my practice was 80.

My clinical work placement was supervised by Mgr. Pavla Kratochvilova. The sessions with my patient were five. They were started on Tuesday 29th of January 2013 and they were continued day by day. Our last session was on Friday 1st of February 2013.

Mainly the therapeutic procedures I used, were manually therapy which took place in our individual therapy room. I used mostly my hands for the examination and therapy, however I used also Swedish ball for some exercises. Goniometer, measurement tapes were the instruments i used for the examination procedures. The patient was using crutches for walking, in all therapeutic sessions.

The patient was fully aware of the examination and therapeutic procedures at any given time and a proposed informed consent was also assigned by the patient and me.

My work has been approved by the Ethics Committee of the Faculty of Physical Education and Sport at Charles University.

3.2 Anamnesis:

Examined person

N. I., 1940, Female

Diagnosis

Total hip replacement (right side)

Code: Z96.6

Present state

Height 1.60m, Weight 56kg, BMI 21.87

Pain level: 5 out of 10 on the right hip (ten is considered to be maximum) according to visual analog scale

HR: 110 beat/min, BP: 140/80 mmHg

Patient lies on bed and is eight days after the operation of total hip replacement on right hip for heavy post dysplastic arthrosis. Date of the surgery was on 22/01/2013 without complications at OTK FNKV by as. MUDr. Bartoska. Operation was done in general anesthesia plus epidural injection. Patient has pain especially when she is moving on the right hip and when she is walking. She uses crutches and she can walk maximum 20 m. She has bandages on both legs for anti-embolism prevention.

History

At the age of 12 years old diagnosed snapping hip syndrome on the right side at Plzen and after arthroscopy of the right hip the nuisance stop. In 2000 doctors noticed a progression of the pre diagnostic disease (snapping hip syndrome). The new diagnosis was heavy post dysplastic arthrosis.

Family anamnesis: Her father died at the age of 85 from acute leukemia. Her mother died at the age of 74 and she had Parkinson's disease. Her sister has vertebral algic syndrome. Her sons are healthy.

Personal anamnesis: Nephrolithiasis. At the age of 12 years old MUDr. Polivkova diagnose snapping hip syndrome and in 1957 had arthroscopy on the right hip.

Social anamnesis: She has two healthy sons. She is married and lives with her husband in a flat on the sixth floor with elevator. She studied analytic chemistry. She is friendly, cooperative and orientated.

Occupational anamnesis: Now she is retired since 2004. She used to work as analytic chemistry teacher in university.

Gynecological anamnesis: Delivered two births without complications. Menstrual cycle started at the age of 12 and stop at the age of 44 because of hysterectomy. Last gynecology examination was on 1/2013.

Operation anamnesis: Hysterectomy for myoma in 1984, arthroscopy of right hip in 1957 for snapping hip syndrome.

Pharmacological anamnesis: Simgal for cholesterol 10mg (0-0-1) and sometimes magnesium for muscle spasm.

Hobbies: Reading books and watching television.

Allergies: None

Previous injuries and trauma: None

Abuses: No smoking. She drinks alcohol occasionally, once in a week.

3.2.1 Previous rehabilitation:

She used to go for physiotherapy sessions after operation for snapping hip syndrome on the right hip in 1957 which included active and passive stretching exercises for shortened muscles, strengthening exercises for weak muscles, correction of walking

pattern, increase ROM exercises, decrease of pain on the region of the right hip joint, correction of her posture. Pain was controlled and therapies were effective.

3.2.2 Indication for rehabilitation:

Doctor suggested a physiotherapeutic program twice a day that includes first of all verticalization of the patient- to learn how to walk with crutches and breathing exercises. Then condition exercises, mobilization of peripheral joints of LE and isometric exercises for gluteal muscles, quadriceps muscles and abductors of thighs. Also active and passive exercises for LE for better ROM and soft tissue techniques for muscles and scar. Motor splint and ergotherapy.

Subjective feeling of the patient: She feels pain 5 out of ten according to visual analog scale on proximal lower extremities (in the area of hips) when she is moving and when she is walking. She feels unstable during walking.

3.3 Initial kinesiology examination

- I. Observation
- II. Postural examination
- III. Gait examination
- IV. Anthropometric examination
- V. Muscle tone examination (palpation)
- VI. Soft tissue examination, by Lewit
- VII. ROM examination, by Kendall
- VIII. Muscle strength test, by Kendall
- IX. Joint Play examination, by Lewit

X. Breathing examination

XI. Neurological examination

3.3.1 Observation

- Patient has bandages on both legs from metatarsal bones up to the knees
- Edema at the region of the right hip joint and at the region of scar
- Scar with stitches 19 cm on the right hip
- Hallux valgus of the big toe (on left feet)
- Hammer toes (on both feet)
- Her psychological condition is good

3.3.2 Postural examination

Was not possible to provide posture examination because patient was standing with crutches. When standing with the crutches patient had forward body position, shoulders were elevated, hips were in flexion position and there was asymmetry of the body with elevation of pelvis on the operated side (right).

3.3.3 Gait examination

The patient provides walking with axillary-crutches (3 tact type of walking). The walking pattern was incorrect and it seems to be unstable. During walking there was forward bending of the trunk, the right leg was in external rotation in the hip joint and she was dragging it and there was no flexion on the right knee. During walking with the crutches, there was no full loading on the operated extremity, patient referred that she use approximately the 1/3 of the load. The foot had incorrect contact during stance

phase, patient doesn't use the heel strike and she goes to early flatfoot. Patient was walking slowly and her steps were short and on the same length.

3.3.4 Anthropometric Measurements

Lower extremities length

	<u>Left</u>	<u>Right</u>
Functional length	83 cm	83,5 cm
Anatomical length	87 cm	87,5 cm

Table 2 - Anthropometric measurements for length of LE

Lower extremities circumference

	<u>Left</u>	<u>Right</u>
Thigh (15 cm above patella)	44,5 cm	42 cm
Calf	32 cm	31 cm

Table 3 - Anthropometric measurements for circumference of LE

3.3.5 Muscle Tone Examination (palpation)

<u>Tested muscle</u>	<u>Left</u>	<u>Right</u>
Rectus femoris	Normal tone	Hypertone
Vastus medialis, lateralis	Normal tone	Hypertone
Adductors (brevis, longus, magnus, pectineus, gracilis, obturatorius externus, gluteus maximus lower fibers)	Normal tone	Hypertone
Iliacus	Normal tone	Hypertone
Psoas (major, minor)	Normal tone	Hypertone
Tensor fasciae latae	Normal tone	Hypertone
Medial Hamstrings (semitendinosus, semimembranosus) Lateral Hamstrings (biceps femoris)	Normal tone	Hypertone
Gluteus medius	Hypertone	Hypertone
Gluteus maximus	Hypotone	Hypotone
Piriformis	Hypertone	Hypertone
Erector spinae	Normal tone	Normal tone
Quadratus lumborum	Normal tone	Normal tone
Rectus abdominis	Hypotone	Hypotone

Biceps brachii	Normal tone	Normal tone
Triceps brachii	Normal tone	Normal tone
Upper trapezius	Hypertone	Hypertone
Levator scapulae	Hypertone	Hypertone

Table 4 - Muscle tone examination, by Lewit

3.3.6 Soft tissue examination, by Lewit

- Examination of fascia by wave touch of LE: restricted barrier of right thigh anteriorly (fascia of flexors group of muscles) and medially (fascia of adductors group of muscles) and resistance is felt.
- Scar: still stitches.

3.3.7 ROM Examination, by Kendall

HIP JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S*	10-0-110	10-0-115	0-0-30 with flexed knee	5-0-60
F	45-0-15	45-0-15	20-0-0**	30-0-0**

Table 5 - Range of motion examination (hip joint), by Kendall

*with flexed knee

**was not provided because is contraindicated

KNEE JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S	0-0-130	0-0-140	0-0-60	0-0-90

Table 6 - Range of motion examination (knee joint), by Kendall

*She felt pain during passive flexion of R knee

ANKLE JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S	25 -0-35	30 -0-40	20 -0-30	25 -0-35

Table 7 - Range of motion examination (ankle joint), by Kendall

WRIST JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S	70 -0-80	80 -0-85	70 -0-80	80-0-85

Table 8 - Range of motion examination (wrist joint), by Kendall

*The examination of the wrists will be also important for us as our patient uses crutches and we want to evaluate if she has full ROM to use the crutches properly.

3.3.8 Muscle Strength Test, by Kendall

<u>Tested Muscle</u>	<u>Left</u>	<u>Right</u>
Gluteus maximus	3-	2-
Abductors	3-	2-
Adductors (performed in supine lying position)	3+	(we didn't provide the examination on the operated leg because is contraindication)
Quadriceps femoris	4+	3-
Hamstrings	4+	3-
Ankle plantar flexors	4+	3-
Tibialis anterior	4+	4
Biceps brachii	4	4
Triceps brachii	4+	4+
Latissimus dorsi	4	4

Table 9 - Muscle strength examination, by Kendall

3.3.9 Examination of joint play, by Lewit

<u>JOINT</u>	<u>Left</u>	<u>Right</u>
Patella in all directions (cranial, caudal, medial, lateral)	No restriction	No restriction
Tibiofibular joint in dorsal and ventral direction	No restriction	Restriction in dorsal and ventral direction
Talocrural joint in dorsal and ventral direction	No restriction	No restriction
Interphalangeal joints of toes, in all the directions (dorsal, plantar and lateral side)	Slight restriction of 1 st -5 th toes in dorsal, plantar and lateral directions	Slight restriction of 1 st -5 th toes in dorsal, plantar and lateral directions
Metatarsophalangeal joints, in all the directions (dorsal, plantar and lateral side)	Slight restriction of 2 nd -5 th toes in dorsal, plantar and lateral directions	Slight restriction of 2 nd -5 th toes in dorsal, plantar and lateral directions
Shoart joint (talus, calcaneus bone, navicular bone, cuboid bone)	No restriction	Slight restriction
Sacroiliac joint in dorsal direction (in prone position)	No restriction	No restriction

Table 10 - Joint play examination, by Lewit

3.3.10 Breathing examination

- Shallow and superficial breathing
- Upper chest and lower abdominals are involved mostly in her breathing

3.3.11 Neurological examination

Superficial sensation

Slight hypesthesia around the scar

Dermatomes examination

	<u>Left</u>	<u>Right</u>
Dermatomes of L1 segment	Normal sensation	Normal sensation
Dermatomes of L2 segment	Normal sensation	Normal sensation
Dermatomes of L3 segment	Normal sensation	Normal sensation
Dermatomes of L4 segment	Normal sensation	Normal sensation
Dermatomes of L5 segment	Normal sensation	Normal sensation
Dermatomes of S1 segment	Normal sensation	Normal sensation
Dermatomes of S2 segment	Normal sensation	Normal sensation

Table 11 - Neurological examination-dermatomes examination

VAS (pain examination)

According to visual analog scale patient felt pain 5 out of 10 on the right hip.

3.3.12 Conclusion of examination

According to the examinations, I conclude that the patient has a pain which is located on the operated hip, when she is moving and during walking, and according to VAS examination pain is characterized as 5 out of 10. There is also edema at the region of right hip and at the region of scar. There is weakness in muscles of the right lower extremities (gluteus maximus, abductors, adductors, quadriceps femoris, hamstrings, ankle plantar flexors). Through muscle tone examination we found hypertone in muscles of right and left lower extremity (piriformis and gluteus medius), hypertonicity in muscles of right lower extremity (rectus femoris, vastus medialis and lateralis, tensor fasciae latae, medial hamstrings, adductors, iliopsoas, upper trapezius, levator scapulae) and also hypotonus in rectus abdominis muscles and gluteus maximus. The ROM is decreased in direction of F, E, ABD of hip joint, F of knee joint and in DF and PF of ankle joint of right LE. Through joint play examination tibiofibular joint in dorsal and ventral direction, as well as the interphalangeal and metatarsophalangeal joints in dorsal, plantar and lateral directions are restricted. Also Shoptart joint is restricted in all directions (lateral and medial, dorsal and plantar). Restriction of fascia barrier of the right thigh anteriorly (fascia of flexors group of muscles) and medially (fascia of adductors group of muscles) according to soft tissue examination. From superficial sensation we found that there is slight hypesthesia around the scar. Her walking pattern was incorrect: during walking there was forward bending of the trunk, the right leg was in external rotation in the hip joint and she was dragging it and there was no flexion on the right knee.

3.4 Short-term and Long-term Physiotherapy Plan

3.4.1 Short-term physiotherapy plan

- Decrease edema
- Improve blood circulation to prevent thrombosis
- Breathing exercises to increase lung capacity
- Verticalization of patient
- Train walking
- Release reflex changes of soft tissue in right thigh and increase elasticity and mobility of the superficial and deep layers
- Release restriction in tibiofibular joint, MTP, IP joints and Hip joint
- Increase ROM in hip joint F, E, ABD in knee joint F and in ankle joint DF, PF
- Active exercises to increase power surrounding hip and knee joint in bed and afterwards in standing position
- Relax hypertonic muscles by PIR for: rectus femoris, vastus medialis and lateralis, adductors, iliopsoas, tensor fasciae latae, medial hamstrings, upper trapezius and levator scapulae
- Advise patient about the contraindicated movements
- Instruct also healthy ways of providing habitual patterns (sitting, standing)

3.4.2 Long-term physiotherapy plan

- Maintain results from short RHB plan into ADL
- Reeducate walking pattern of patient
- Help patient to gain her independence by good functioning of the operated LE

- Increase the ROM of operated leg so that the patient can be adapted with the ADL

3.5 Therapy progress

Tuesday on 29.01.2013 (in the afternoon)

Goals of today's therapeutic unit

- Decrease edema
- Prevent thromboembolism
- Breathing exercises to increase lung capacity
- Release reflex changes of soft tissue in right thigh and increase elasticity and mobility of the superficial and deep layers
- Train transitioning positions and verticalization
- Increase ROM in knee joints (F)
- Instruct patient for correct posture and walking
- Advice patient about the contraindicated movements

Execution

1. Application of cold pack for 15 minutes to decrease edema in the region of right hip and scar. We put a wet towel between the cold pack and patients skin to avoid cold burning
2. Thromboembolic prevention exercises in supine lying position: ankle pumps (plantar and dorsal flexion in both ankles) and ankle rotations. Repetition: 10 times/2 sets
3. Breathing exercises: deep abdominal breathing combined with flexion of the arms during exhalation- actively patient contract the abdominal muscles

4. Soft tissue techniques, by Lewit: to increase mobility of the fascia of the R thigh
5. Verticalization- train transitioning positions (from supine to side-lying on healthy side, to prone and after sitting), improving muscle strength and power in lower and upper extremities: Patient is in sitting position. Both hands are resting on bed behind back with the fingers toward back and she moves her body forward and backward. With fist hands pushes on bed and trying to straighten her spine. Patient while is sitting raises feet on toes and on heels and after she walks with one foot forward and backward and then with the other foot.
6. Active F of knee joints to increase ROM in sitting position with pillow between thighs
7. Instruct patient for correct posture and to 3 point walking: first she puts the crutches forward after the unhealthy leg and last the healthy leg. We show in details how the movement is done and then we ask the patient to provide it
8. Advice patient about the contraindicated movements: no hip F more than 90 degrees, no hip ADD and ER in order to avoid any dislocation of the operated hip

Results

Objective

This is our first therapy. It is obvious that ROM is starting to be gained in right knee joint.

The patient was able to perform verticalization with no effort.

Right thigh fascia still restricted.

She can easily manage to change positions from supine to side-lying on healthy side and to prone.

Walking pattern was still incorrect.

Subjective

Patient got tired early.

She followed our commands with no specific problems.

Wednesday on 30.01.2013 (in the morning)

Goals of today's therapeutic unit

- Decrease edema
- Prevent thromboembolism
- Breathing exercises to increase lung capacity
- Release reflex changes of soft tissue in right thigh and increase elasticity and mobility of the superficial and deep layers
- Relax the hypertonic muscles (right and left m. upper trapezius, right and left m. levator scapulae, left m. piriformis)
- Increase ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF
- Strengthening the weak muscles (gluteus maximus (both lower extremities), abductors (both lower extremities), adductors (right lower extremity), hamstrings (right lower extremity), ankle plantar flexors (right lower extremity))

Execution

1. Application of cold pack for 15 minutes to decrease edema in the region of right hip and scar. We put a wet towel between the cold pack and patients skin to avoid cold burning
2. Thromboembolic prevention exercises in supine lying position: ankle pumps (plantar and dorsal flexion in both ankles) and ankle rotations. Repetition: 10 times/2 sets
3. Breathing exercises: deep abdominal breathing combined with flexion of the arms during exhalation- actively patient contract the abdominal muscles
4. Soft tissue techniques, by Lewit: to increase mobility of the fascia of the R thigh

5. PIR technique for the hypertonic muscles (right and left m. upper trapezius, right and left m. levator scapulae, left m. piriformis)
6. Postoperative exercises which they will help in increasing ROM and strengthening the weak muscles can be combined:
 - M. quadriceps femoris contractions: Patient is in supine position. She extends both knees, she puts her feet in dorsal flexion and tries to tighten the m. quadriceps femoris. She holds for 5 sec and then she releases. Repetition: 6 times
 - Bed-supported knee bends: Patient is in supine position and she is trying to provide flexion in hip and knee joint by sliding the foot on the bed and return back. This exercise will be done as an assisted movement. At the point patient stops, we help her to continue. When she reaches the final point we press a little bit more to gain in ROM in knee joint. The exercise can be done up to 90° flexion of right hip joint and not more. There is no restriction for left hip joint. It is a useful exercise for gaining ROM and strengthening the weak muscles. We provide the exercise on both lower extremities. Repetition: 6 times / 1 set each lower extremity.
 - Abduction exercise: Patient is in supine position and she is trying to slide her leg to the side as far as she can and then return back. Again we help her to provide this movement and at the reach point we press a little bit more and hold there for increasing the ROM. She is providing this exercise for both lower extremities. Repetition: 6 times / 1 set each lower extremity.
 - Raises of pelvis: Patient is in supine position with her arms along her trunk. She flexes both hip and knee joints and she lifts her pelvis up. She holds for 5 sec and then she returns back. Through this procedure stretching also of right and left m. iliopsoas and right and left m. rectus femoris is done. Repetition: 5 raises.
 - Gluteal m. contractions: Our patient knows how to turn on the side. We put a pillow between her thighs to prevent adduction in operated hip joint (contraindication). She turns on the side and then in prone position. In this position she tightens the gluteal muscles and hold for 5 sec. Repetition: 6 times.
 - Hip extension: Patient is in prone position. She is trying first to contract the gluteal muscles and then to provide hip extension. The exercise is done by our

help because it is very difficult for her to provide it. She performs this exercise for both lower extremities.

- In prone position we provide assisted extension of right hip joint and assisted flexion of right knee joint for stretching the right m. rectus femoris.
- Sitting position: Patient is coming in sitting position and close to the edge of the bed. She stays for a while in this position. She does not feel dizziness. With a pillow between thighs firstly she provides knee flexion and after hip flexion with bend knees. Exercises done on both lower extremities.
- Standing position: She is coming in standing position. We instruct her to try to have a straight position, look forward and have physiological position of the lower extremities (she is trying not to have rotations on the hip joint). The feet are looking also forward.

Results

Objective

Stiffness round the scar (lower part) and is still edema.

Hypertonic muscles are relaxed (right and left m. upper trapezius, right and left m. levator scapulae, left m. piriformis)

Slight increase of ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF.

Also she started to provide the post operative exercises very well.

Subjective

We made the necessary intervals between exercises so patient had a rest. She follows our commands perfect.

Wednesday on 30.01.2013 (in the afternoon)

Goals of today's therapeutic unit

- Prevent thromboembolism

- Unblock restricted joints with Joint play techniques for: tibiofibular joint in dorsal and ventral directions (right side), interphalangeal joints of 1st-5th toes in dorsal, plantar and lateral directions (both sides), metatarsophalangeal joints of 2nd-5th toes in dorsal, plantar and lateral directions (both sides) and Shopart joint (right side)
- Increase ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF
- Train walking

Execution

1. Thromboembolic prevention exercises in supine lying position: ankle pumps (plantar and dorsal flexion in both ankles) and ankle rotations. Repetition: 10 times/2 sets
2. Joint play techniques (by Lewit) for : tibiofibular joint in dorsal and ventral directions (right side), interphalangeal joints of 1st-5th toes in dorsal, plantar and lateral directions (both sides), metatarsophalangeal joints of 2nd-5th toes in dorsal, plantar and lateral directions (both sides) and Shopart joint (right side).
3. Postoperative exercises which they will help in increasing ROM and strengthening the weak muscles can be combined:
 - M. quadriceps femoris contractions: Patient is in supine position. She extends both knees, she puts her feet in dorsal flexion and tries to tighten the m. quadriceps femoris. She holds for 5 sec and she releases. Repetition: 6 times
 - Bed-supported knee bends: Patient is in supine position and she is trying to provide flexion in hip and knee joint by sliding the foot on the bed and return back. This exercise will be done as an assisted movement. At the point patient stops, we help her to continue. When she reaches the final point we press a little bit more to gain in ROM in knee joint. The exercise can be done up to 90° flexion of right hip joint and not more. There is no some restriction for left hip joint. It is a useful exercise for gaining ROM and strengthening the weak

muscles. We provide the exercise on both lower extremities. Repetition: 6 times / 1 set each lower extremity.

- Abduction exercise: Patient is in supine position and she is trying to slide her leg to the side as far as he can and then return back. Again we help her to provide this movement and at the reach point we press a little bit more and hold there for increasing the ROM. She is providing this exercise for both lower extremities. Repetition: 6 times / 1 set each lower extremity.
 - Raises of pelvis: Patient is in supine position with her arms along her trunk. She flexes both hip and knee joints and she lifts her pelvis up. She holds for 5 sec and then she returns back. Through this procedure stretching also of right and left m. iliopsoas and right and left m. rectus femoris is done. Repetition: 5 raises.
 - Gluteal m. contractions: Our patient knows how to turn on the side. We put a pillow between her thighs to prevent adduction in operated hip joint (contraindication). She turns on the side and then in prone position. In this position she tightens the gluteal muscles and hold for 5 sec. Repetition: 6 times.
 - Hip extension: Patient is in prone position. She is trying first to contract the gluteal muscles and then to provide hip extension. The exercise is done by our help because it is very difficult for her to provide it. She performs this exercise for both lower extremities.
 - In prone position we provide assisted extension of right hip joint and assisted flexion of right knee joint for stretching the right m. rectus femoris.
 - Sitting position: Patient is coming in sitting position and close to the edge of the bed. She stays for a while in this position. She does not feel dizziness. We try to disturb her balance while she resists to this action.
 - Standing position: She is coming in standing position. We instruct her to try to have a straight position, look forward and have physiological position of the lower extremities (she is trying not to have rotations on the hip joint). The feet are looking also forward.
4. Instruct patient for correct posture and to 3 point walking: first she puts the crutches forward after the unhealthy leg and last the healthy leg. We show in details how the movement is done and then we ask the patient to provide it.
 5. Motor splint: passive hip F and E for 20 minutes

Results

Objective

Passive hip F with Motor splint was 50 degrees.

We noticed that she started to correct her walking pattern.

Subjective

We made the necessary intervals between exercises so patient had a rest. She follows our commands perfect.

In the scale from 0 to 10 she mentioned 3 on the right hip.

Thursday on 31.01.2013 (in the morning)

Goal of today's therapeutic unit

- Decrease stiffness round the scar
- Prevent thromboembolism
- Strengthening the weak muscles (gluteus maximus (both lower extremities), abductors (both lower extremities), adductors (right lower extremity), hamstrings (right lower extremity), ankle plantar flexors (right lower extremity))
- Increase ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF

Execution

1. Application of hot roll round the scar for ten minutes to decrease stiffness.
2. Thromboembolic prevention exercises in supine lying position: ankle pumps (plantar and dorsal flexion in both ankles) and ankle rotations. Repetition: 10 times/2 sets
3. Postoperative exercises which they will help in increasing ROM and strengthening the weak muscles can be combined:

- M. quadriceps femoris contractions: Patient is in supine position. She extends both knees, she puts her feet in dorsal flexion and tries to tighten the m. quadriceps femoris. She holds for 5 sec and then she releases. Repetition: 6 times
- Bed-supported knee bends: Patient is in supine position and she is trying to provide flexion in hip and knee joint by sliding the foot on the bed and return back. This exercise will be done as an assisted movement. At the point patient stops, we help her to continue. When she reaches the final point we press a little bit more to gain in ROM in knee joint. The exercise can be done up to 90° flexion of right hip joint and not more. There is no restriction for left hip joint. It is a useful exercise for gaining ROM and strengthening the weak muscles. We provide the exercise on both lower extremities. Repetition: 6 times / 1 set each lower extremity.
- Abduction exercise: Patient is in supine position and she is trying to slide her leg to the side as far as she can and then return back. Again we help her to provide this movement and at the reach point we press a little bit more and hold there for increasing the ROM. She is providing this exercise for both lower extremities. Repetition: 6 times / 1 set each lower extremity.
- Raises of pelvis: Patient is in supine position with her arms along her trunk. She flexes both hip and knee joints and she lifts her pelvis up. She holds for 5 sec and then she returns back. Through this procedure stretching also of right and left m. iliopsoas and right and left m. rectus femoris is done. Repetition: 5 raises.
- Gluteal m. contractions: Our patient knows how to turn on the side. We put a pillow between her thighs to prevent adduction in operated hip joint (contraindication). She turns on the side and then in prone position. In this position she tightens the gluteal muscles and hold for 5 sec. Repetition: 6 times.
- Hip extension: Patient is in prone position. She is trying first to contract the gluteal muscles and then to provide hip extension. The exercise is done by our help because it is very difficult for her to provide it. She performs this exercise for both lower extremities.
- In prone position we provide assisted extension of right hip joint and assisted flexion of right knee joint for stretching the right m. rectus femoris.
- Sitting position: Patient is coming in sitting position and close to the edge of the bed. She stays for a while in this position. She does not feel dizziness. We try to

disturb her balance while she resists to this action. With a pillow between thighs firstly she provides knee flexion and after hip flexion with bend knees. Exercises done on both lower extremities.

- Standing position: She is coming in standing position. We instruct her to try to have a straight position, look forward and have physiological position of the lower extremities (she is trying not to have rotations on the hip joint). The feet are looking also forward.
4. Motor splint: passive hip F and E for 20 minutes

Results

Objective

Still stiffness round the scar.

Passive hip F on Motor splint was increased to 67 degrees.

The ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF was increased approximately 5 degrees

Subjective

During right knee F patient felt some pain on thigh in the end of the movement.

In the scale from 0 to 10 she mentioned 3 on the right hip.

Thursday on 31.01.2013 (in the afternoon)

Goal of today's therapeutic unit

- Prevent thromboembolism
- Unblock restricted joints with Joint play techniques for: tibiofibular joint in dorsal and ventral directions (right side), interphalangeal joints of 1st-5th toes in dorsal, plantar and lateral directions (both sides), metatarsophalangeal joints of 2nd-5th toes in dorsal, plantar and lateral directions (both sides) and Shopart joint (right side)

- Increase ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF
- Train walking

Execution

1. Thromboembolic prevention exercises in supine lying position: ankle pumps (plantar and dorsal flexion in both ankles) and ankle rotations. Repetition: 10 times/2 sets
2. Joint play techniques (by Lewit) for : tibiofibular joint in dorsal and ventral directions (right side), interphalangeal joints of 1st-5th toes in dorsal, plantar and lateral directions (both sides), metatarsophalangeal joints of 2nd-5th toes in dorsal, plantar and lateral directions (both sides) and Shopart joint (right side).
3. Postoperative exercises which they will help in increasing ROM and strengthening the weak muscles can be combined:
 - M. quadriceps femoris contractions: Patient is in supine position. We put an overball under the knee, she extend the knee, she puts her feet in dorsal flexion and tries to tighten the m. Quadriceps femoris. She holds for 5 sec and the she releases. We provide the exercise on both lower extremities. Repetition: 6 times
 - Bed-supported knee bends: Patient is in supine position, we put an overball under the heel and she is trying to provide flexion in hip and knee joint by sliding the foot on the overball and return back. This exercise will be done as an assisted movement. At the point patient stops, we help her to continue. When she reaches the final point we press a little bit more to gain in ROM in knee joint. The exercise can be done up to 90° flexion of right hip joint and not more. There is no some restriction for left hip joint. It is a useful exercise for gaining ROM and strengthening the weak muscles. We provide the exercise on both lower extremities. Repetition: 6 times / 1 set each lower extremity.
 - Abduction exercise: Patient is in supine position and she is trying to slide her leg to the side as far as he can and then return back. Again we help her to provide this movement and at the reach point we press a little bit more and hold there for

increasing the ROM. She is providing this exercise for both lower extremities.
Repetition: 6 times / 1 set each lower extremity.

- Raises of pelvis: Patient is in supine position with her arms along her trunk. She flexes both hip and knee joints and she lifts her pelvis up. She holds for 5 sec and then she returns back. Through this procedure stretching also of right and left m. iliopsoas and right and left m. rectus femoris is done. Repetition: 5 raises.
 - Gluteal m. contractions: Our patient knows how to turn on the side. We put a pillow between her thighs to prevent adduction in operated hip joint (contraindication). She turns on the side and then in prone position. In this position she tightens the gluteal muscles and hold for 5 sec. Repetition: 6 times.
 - Hip extension: Patient is in prone position. She is trying first to contract the gluteal muscles and then to provide hip extension. The exercise is done by our help because it is very difficult for her to provide it. She performs this exercise for both lower extremities.
 - In prone position we provide assisted extension of right hip joint and assisted flexion of right knee joint for stretching the right m. rectus femoris.
 - Sitting position: Patient is coming in sitting position and close to the edge of the bed. She stays for a while in this position. She does not feel dizziness. With a pillow between thighs firstly she provides knee flexion and after hip flexion with bend knees. Exercises done on both lower extremities.
 - Standing position: She is coming in standing position. We instruct her to try to have a straight position, look forward and have physiological position of the lower extremities (she is trying not to have rotations on the hip joint). The feet are looking also forward.
4. Instruct patient for correct posture and to 3 point walking: first she puts the crutches forward after the unhealthy leg and last the healthy leg. We show in details how the movement is done and then we ask the patient to provide it.

Results

Objective

Release of restricted joints.

Her walking pattern was better. She was more stable during walking and the external rotation in hip joint was decreased.

Subjective

She is not getting tired fast and she is able to provide most of the exercises.

Friday on 01.02.2013 (in the morning)

Goal of today's therapeutic unit

- Decrease edema
- Prevent thromboembolism
- Release reflex changes of soft tissue in right thigh and increase elasticity and mobility of the superficial and deep layers
- Strengthening the weak muscles (gluteus maximus (both lower extremities), abductors (both lower extremities), adductors (right lower extremity), hamstrings (right lower extremity), ankle plantar flexors (right lower extremity))
- Increase ROM in hip joint (F, E and ABD), in knee joint F and in ankle joint DF and PF
- Train walking

Execution

1. Application of cold pack for 15 minutes to decrease edema in the region of right hip and scar. We put a wet towel between the cold pack and patients skin to avoid cold burning
2. Thromboembolic prevention exercises in supine lying position: ankle pumps (plantar and dorsal flexion in both ankles) and ankle rotations. Repetition: 10 times/2 sets

3. Soft tissue techniques, by Lewit: to increase mobility of the fascia of the R thigh and round of scar
4. Postoperative exercises which they will help in increasing ROM and strengthening the weak muscles can be combined:
 - M.quadriceps femoris contractions: Patient is in supine position. We put an overball under the knee, she extend the knee, she puts her feet in dorsal flexion and tries to tighten the m. Quadriceps femoris. She holds for 5 sec and the she releases. We provide the exercise on both lower extremities. Repetition: 10 times
 - Bed-supported knee bends: Patient is in supine position, we put an overball under the heel and she is trying to provide flexion in hip and knee joint by sliding the foot on the overball and return back. This exercise will be done as an assisted movement. At the point patient stops, we help her to continue. When she reaches the final point we press a little bit more to gain in ROM in knee joint. The exercise can be done up to 90° flexion of right hip joint and not more. There is no some restriction for left hip joint. It is a useful exercise for gaining ROM and strengthening the weak muscles. We provide the exercise on both lower extremities and after without the overball. Repetition: 10 times / 1 set each lower extremity.
 - Abduction exercise: Patient is in supine position and she is trying to slide her leg to the side as far as he can and then return back. Again we help her to provide this movement and at the reach point we press a little bit more and hold there for increasing the ROM. She is providing this exercise for both lower extremities. Repetition: 6 times / 1 set each lower extremity.
 - Raises of pelvis: Patient is in supine position with her arms along her trunk. She flexes both hip and knee joints and she lifts her pelvis up. She holds for 5 sec and then she returns back. Through this procedure stretching also of right and left m. iliopsoas and right and left m. rectus femoris is done. Repetition: 5 raises.
 - Gluteal m. contractions: Our patient knows how to turn on the side. We put a pillow between her thighs to prevent adduction in operated hip joint (contraindication). She turns on the side and then in prone position. In this position she tightens the gluteal muscles and hold for 5 sec. Repetition: 6 times.

- Hip extension: Patient is in prone position. She is trying first to contract the gluteal muscles and then to provide hip extension. The exercise is done by our help because it is very difficult for her to provide it. She performs this exercise for both lower extremities.
 - In prone position we provide assisted extension of right hip joint and assisted flexion of right knee joint for stretching the right m. rectus femoris.
 - Sitting position: Patient is coming in sitting position and close to the edge of the bed. She stays for a while in this position. She does not feel dizziness. With a pillow between thighs firstly she provides knee flexion and after hip flexion with bend knees. Exercises done on both lower extremities.
 - Standing position: She is coming in standing position. We instruct her to try to have a straight position, look forward and have physiological position of the lower extremities (she is trying not to have rotations on the hip joint). The feet are looking also forward.
5. Instruct patient for correct posture and to 3 point walking: first she puts the crutches forward after the unhealthy leg and last the healthy leg. We show in details how the movement is done and then we ask the patient to provide it.
 6. Motor splint: passive hip F and E for 20 minutes

Results

Objective

Still stiffness round the scar.

Subjective

Patient is able to provide the exercises.

Patient felt pain on right gluteal m.

In the scale from 0 to 10 she mentioned 3 on the right hip.

3.6 Final kinesiological examination

- I. Observation
- II. Postural examination
- III. Gait examination
- IV. Anthropometric examination
- V. Muscle tone examination (palpation)
- VI. Soft tissue examination, by Lewit
- VII. ROM examination, by Kendall
- VIII. Muscle strength test, by Kendall
- IX. Joint Play examination, by Lewit
- X. Breathing examination
- XI. Neurological examination

I. Final Observation

- Patient has bandages on both legs from metatarsal bones up to the knees
- **Edema is slight decreased at the region of the right hip joint and at the region of scar**
- Scar with stitches 19 cm on the right hip
- Hallux valgus of the big toe (on left feet)
- Hammer toes (on both feet)
- Her psychological condition is good

II. Final Postural examination

It was not possible to provide posture examination because patient was standing with crutches. When standing with the crutches **forward body position slightly decreased (improved), elevation of shoulders slightly decreased (improved), flexion of hips slightly decreased (improved)** and there was asymmetry of the body with elevation of pelvis on the operated side (right).

III. Final Gait examination

The patient provides walking with axillary-crutches (3 tact type of walking). **The walking pattern was improved and it is more objective stable.** During walking **forward bending of the trunk decreased, external rotation in the hip joint also decreased and she wasn't dragging it and there is flexion on the right knee.** During walking with the crutches, there was no full loading on the operated extremity, **according to our advice patient use approximately the 1/4 of the load. The foot had correct contact during walking.** Patient was walking slowly and her steps were short and on the same length.

IV. Final Anthropometric examination

Lower extremities length

	<u>Left</u>	<u>Right</u>
Functional length	83 cm	83,5 cm
Anatomical length	87 cm	87,5 cm

Table 12 - Final anthropometric measurements for length of LE

Lower extremities circumference

	<u>Left</u>	<u>Right</u>
Thigh (15 cm above patella)	44,5 cm	43,5 cm (improved)
Calf	32 cm	32 cm (improved)

Table 13 - Final anthropometric measurements for circumference of LE

V. Final Muscle tone examination (palpation)

<u>Tested muscle</u>	<u>Left</u>	<u>Right</u>
Rectus femoris	Normal tone	Hypertone
Vastus medialis, lateralis	Normal tone	Hypertone
Adductors (brevis, longus, magnus, pectineus, gracilis, obturatorius externus, gluteus maximus lower fibers)	Normal tone	Hypertone
Iliacus	Normal tone	Hypertone
Psoas (major, minor)	Normal tone	Hypertone
Tensor fasciae latae	Normal tone	Hypertone
Medial Hamstrings (semitendinosus, semimembranosus) Lateral Hamstrings (biceps femoris)	Normal tone	Hypertone
Gluteus medius	Normal tonus (improved)	Hypertone
Gluteus maximus	Hypotone	Hypotone

Piriformis	Normal tonus (improved)	Hypertone
Erector spinae	Normal tone	Normal tone
Quadratus lumborum	Normal tone	Normal tone
Rectus abdominis	Normal tonus (improved)	Normal tonus (improved)
Biceps brachii	Normal tone	Normal tone
Triceps brachii	Normal tone	Normal tone
Upper trapezius	Normal tonus (improved)	Normal tonus (improved)
Levator scapulae	Normal tonus (improved)	Normal tonus (improved)

Table 14 - Final muscle tone examination, by Lewit

VI. Final Soft tissue examination, by Lewit

- Examination of fascia by wave touch of LE: restricted barrier of right thigh anteriorly (fascia of flexors group of muscles) and medially (fascia of adductors group of muscles) **decreased** and **elasticity improved**.
- Scar: still stitches.

VII. Final ROM examination, by Kendall

HIP JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S*	10-0-115 (improved)	10-0-120 (improved)	0-0-55 with flexed knee (improved)	5-0-75 (improved)
F	45-0-15	45-0-15	25-0-0** (improved)	35-0-0** (improved)

Table 15 - Final range of motion examination (hip joint), by Kendall

*with flexed knee

**was not provided because is contraindicated

***she felt pain in the end of the movement during passive flexion of right hip

KNEE JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S	0-0-135 (improved)	0-0-145 (improved)	0-0-90 (improved)	0-0-95 (improved)

Table 16 - Final range of motion examination (knee joint), by Kendall

ANKLE JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S	25 -0-35	30 -0-45 (improved)	20 -0-30	25 -0-40 (improved)

Table 17 - Final range of motion examination (ankle joint), by Kendall

WRIST JOINT				
Plane	<u>Left</u>		<u>Right</u>	
	Active Movement	Passive Movement	Active Movement	Passive Movement
S	70 -0-80	80 -0-85	70 -0-80	80-0-85

Table 18 - Final range of motion examination (wrist joint), by Kendall

VIII. Final Muscle strength test, by Kendall

<u>Tested Muscle</u>	<u>Left</u>	<u>Right</u>
Gluteus maximus	3+	2+
Abductors	4	2+
Adductors (performed in supine lying position)	3+	(we didn't provide the examination on the operated leg because is contraindication)
Quadriceps femoris	4+	3+
Hamstrings	4+	3+
Ankle plantar flexors	4+	4
Tibialis anterior	4+	4
Biceps brachii	4	4
Triceps brachii	4+	4+

Latissimus dorsi	4	4
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Table 19 - Final muscle strength examination, by Kendall

IX. Final Joint play examination, by Lewit

<u>JOINT</u>	<u>Left</u>	<u>Right</u>
Patella in all directions (cranial, caudal ,medial, lateral)	No restriction	No restriction
Tibiofibular joint in dorsal and ventral direction	No restriction	Improved movement in dorsal and ventral direction
Talocrular joint in dorsal and ventral direction	No restriction	No restriction
Interphalangeal joints of toes, in all the directions (dorsal, plantar and lateral side)	Improved movement of 1st-5th toes in dorsal, plantar and lateral directions	Improved movement of 1st-5th toes in dorsal, plantar and lateral directions
Metatarsophalangeal joints, in all the directions (dorsal, plantar and lateral side)	Improved movement of 2nd-5th toes in dorsal, plantar and lateral directions	Improved movement of 2nd-5th toes in dorsal, plantar and lateral directions
Shopart joint (talus, calcaneus bone, navicular bone,cuboit bone)	No restriction	Improved movement
Sacroiliac joint in dorsal direction (in prone	No restriction	No restriction

position)		
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Table 20 - Final Joint play examination, by Lewit

X. Final breathing examination

- Shallow and superficial breathing
- Upper chest and lower abdominals are involved mostly in her breathing

XI. Final Neurological examination

Superficial sensation

Slight hypesthesia around the scar.

Dermatomes examination

	<u>Left</u>	<u>Right</u>
Dermatomes of L1 segment	Normal sensation	Normal sensation
Dermatomes of L2 segment	Normal sensation	Normal sensation
Dermatomes of L3 segment	Normal sensation	Normal sensation
Dermatomes of L4 segment	Normal sensation	Normal sensation
Dermatomes of L5 segment	Normal sensation	Normal sensation
Dermatomes of S1 segment	Normal sensation	Normal sensation

Dermatomes of S2 segment	Normal sensation	Normal sensation
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Table 21 - Final Neurological examination-dermatomes examination

VAS (pain examination)

According to visual analog scale patient felt pain **3** out of 10 on the right hip

3.7 Evaluation of the Effect of the Therapy

Patient had her operation of total hip replacement (right side) on 22nd of January 2013 and we started the therapy on Tuesday 29th of January 2013.

From my initial kinesiologic examination I estimated that there were problems and limitations referring to her movement, muscles, soft tissues, posture and gait.

The effect of the therapy was positive for our patient as there was an improvement in all the above fields.

Through the therapeutic procedures which have been chosen there was an increasing in ROM of right hip and knee joint. Also strengthening of the weaker muscles and relaxation of the hypertonus muscles was important improvement as it helps for increasing in ROM.

Another important branch of our therapy was the release and improvement of the mobility of fascia of the right thigh.

All the above helped the patient to correct her posture and gait through also my instructions and commands. After some sessions the posture of our patient improved and she was walking fluently and more freely with her crutches in three point walking.

Patient should continue exercising in order to strengthen more the muscles of the operated leg and increase the range of motion. Walking will be also useful for her. By following what I suggested her the prognosis will be very good as she will reach a perfect condition for her health and activities of her daily living.

4. CONCLUSION

Patient during the whole sessions of the physiotherapy approach was very cooperative, friendly and was positive.

Being operated in hip joint with total replacement is not something easy as it needs a good rehabilitation program to return in the previous healthy condition. The good psychology of the patient played a very important role to the quick recovery.

I met the patient eight days after the operation and established for her a suitable physiotherapeutic approach in order to relieve the post-operative pain and edema located on the right hip region, increase ROM, relax and strength the muscles. Also among the goals of the treatment was to increase as well the lung capacity and further more enabling her to return back to her ADL.

Patient at the end of each session was feeling better. The result was an improved posture and walking was more confident and less painful.

I had a good time during my practice and I received it as a great experience. I enjoyed while working with the patients and offering them the best approach to their problem.

I worked fluently and with not any complications with my patient, taking advantage of my knowledge that I gained through the years of my studies at Charles University.

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6. SUPPLEMENTS

6.1 List of pictures

- 27) Picture 1. *Anatomy of the hip joint*. Retrieved April 8, 2013, from <http://www.orthoinfo.aaos.org/topic.cfm?topic=A00572>
- 28) Picture 2. *Hip joint ligaments*. Retrieved April 8, 2013, from <https://www.google.com.cy/search?q=hip+joint+ligaments&tbm=isch&tbo=u&source=univ&sa=X&ei=DaRhUufqFcnvswbZ8IHICw&sqi=2&ved=0CCcQsAQ&biw=1034&bih=627>
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- 30) Picture 4. *Hip joint movements*. Retrieved April 9, 2013, from https://www.google.com.cy/search?q=hip+joint+movements&tbm=isch&tbo=u&source=univ&sa=X&ei=0qZhUs3uFI_MtAaxu4CQAw&sqi=2&ved=0CD4QsAQ&biw=1034&bih=627
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6.3 List of abbreviations

- F: Flexion
- E: Extension
- ABD: Abduction
- ADD: Adduction
- ER: External rotation
- DF: Dorsal flexion
- PF: Plantar flexion
- MTP: Metatarsophalangeal
- IP: Interphalangeal
- ROM: Range of motion
- PIR: Post isometric relaxation
- LE: Lower extremity
- R: Right
- BMI: Body mass index
- VAS: Visual Analog Scale
- RHB: Rehabilitation
- Mg: Miligram
- m: Muscle
- ADL: Activities of daily living