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FACULTY OF PHYSICAL EDUCATION AND SPORT
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Rehabilitation after Total Hip Replacement Operation
Bachelor Thesis

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Declaration

I declare that this bachelor thesis I wrote it by myself with the help of the sources which I refer to in the list of literature.

Signature

Preface

The following thesis is about the rehabilitation after total hip joint replacement. It was done at Malvazinki Clinic in Prague from 30-01-2006 until 10-02-2006. I have chosen to do this subject for my bachelor thesis, because this kind of operation is quit often done in the elderly people and I wanted to have more knowledge and experience about it. By the age of 90 years old 32% of women and 17% of men will need a total hip joint replacement operation.

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.

Acknowledgement

I would like to thank my supervisor Mgr Miroslavá Jalovcová for the help and supervision during the realization of this work.

1. Summary

The following bachelor thesis is about the rehabilitation after total hip joint replacement. The thesis is divided into two parts. The general and special part.

In the general part I explain generally about the anatomy and the function of the hip joint. Then I wrote what is medically concerned about the total hip joint replacement and the approach of the surgery. After this, is written about the pre operation and post operation care of the patient including all the examination techniques.

In the special part is the anamnesis of the patient, the initial kinesiology examination, the short term and long term rehabilitation plan, the day by day programme analytically, the final kinesiological examination, the therapy proposal and the conclusion.

Contents

2. General part

2.1 Anatomy of hip joint

The hip joint is a multiaxial ball and socket synovial joint formed by the articulation of the rounded head of femur and the cuplike acetabulum of the pelvis. It forms the primary connection between the bones of the lower limb and the axial skeleton of the trunk and pelvis. Both joint surfaces are covered with a strong but lubricated layer called articular hyaline cartilage. The cuplike acetabulum forms at the union of three pelvic bones (ileum, ischium and pubic bone). The depth of the acetabulum is increased by a fibrocartilaginous rim called a labrum that grips the head of the femur and secures it in the joint.

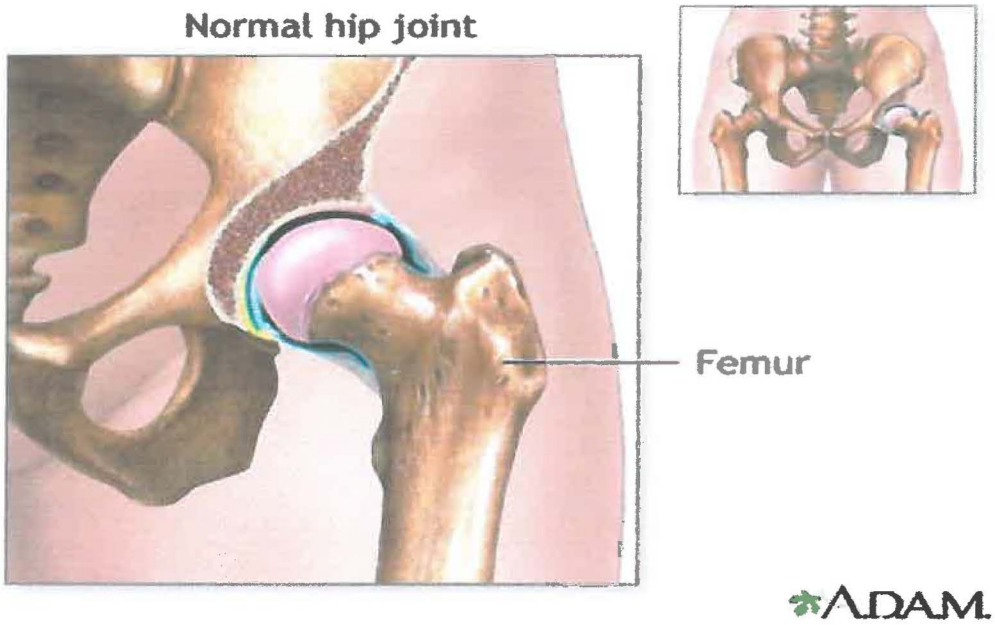
The large head of the femur is completely covered in hyaline cartilage except for a small area called the fovea or pit. This is the site of attachment for an intracapsular ligament that attaches directly from the head of the femur to the acetalum.

The strong but loose fibrous capsule of the hip joint permits the hip joint to have the second largest range of movement (second only to the shoulder) and yet support the weight of the body, arms and head.

(Marieb 2000, Martini 2000, Netter 2001)

The length of neck of femur and its inclinations to the body of the bone have the effect of converting the angular movements of flexion, extension, adduction, and abduction partially into rotation movements in the joint. Thus when the thigh is flexed or extended, the head of the femur, on account of the medial inclination of the neck, rotates within the acetabulum with only a slight amount of gliding. The forward slope of the neck similarly affects the movements of adduction and abduction. Conversely rotation of the thigh which is permitted by the upward inclination of the neck, is not a simple rotation of the head of the femur in the acetabulum, but is accompanied by a certain amount of gliding.

(Calais-Germain1993, http://en.wikipedia.org/wiki/Hip)



Picture 1. Normal hip joint. (http://health.allrefer.com/health/hip-joint-replacement-hip-joint-replacement-series.html)

2.2 Blood supply and nerve supply of the hip joint

The hip joint is supplied with blood from the medial and lateral circumflex femoral arteries, which are both usually branches of the deep artery of the thigh (profunda femoris), but may also arise directly from the femoral artery. There is also a small contribution from a small artery in the ligament of the head of the femur which is a branch of the posterior division of the obturator artery, which becomes important to avoid avascular necrosis of the head of the femur when the blood supply from the medial and lateral circumflex arteries are disrupted (e.g. through fracture of the neck of the femur along their course).

The hip joint is supplied by the femoral nerve, the obturator nerve, superior gluteal nerve, and the nerve to quadratus femoris.

(Moore 1999, Netter 2001)

2.3 Muscles of the hip

We distinguish the muscles of the hip joint according to the movement that they make. Some of these muscles are responsible for more than one type of movement, as different areas of the muscle act on tendons in different ways. We have six groups of muscles.

- Flexors.
- Extensors
- Lateral rotators
- Medial rotators
- Abductors
- Adductors

2.3.1 Flexor group

- Tensor fascia lata
- Pectineus
- Sartorius
- Gracilis
- Psoas major and minor
- Iliacus
- Rectus femoris
- Adductor brevis, longus, magnus ant. fibers
- Glutesu med. ant. fibers
- Gluteus minimus

2.3.2 Extensor group

- Gluteus maximus
- Semitendinosus
- Semimembranosus
- Biceps femoris
- Adductor magnus- posterior part
- Gluteus medius posterior fibers

- Piriformis
- Gemellus superior
- Obturatorius externus

2.3.3 Adductor group

- Adductor brevis
- Adductor longus
- Adductor magnus
- Pectineus
- Gracilis
- Obturatorius externus
- Glutesus maximus low fibres

2.3.4 Abductor group

- Gluteus medius
- Gluteus minimus
- Sartorius
- Tensor fascia latae
- Psoas major
- Iliacus
- Gemellus inferior
- Gemellus superior
- Glutesus maximus upper fibers
- Piriformis
- Obturatoris externus

2.3.5 Lateral rotator group

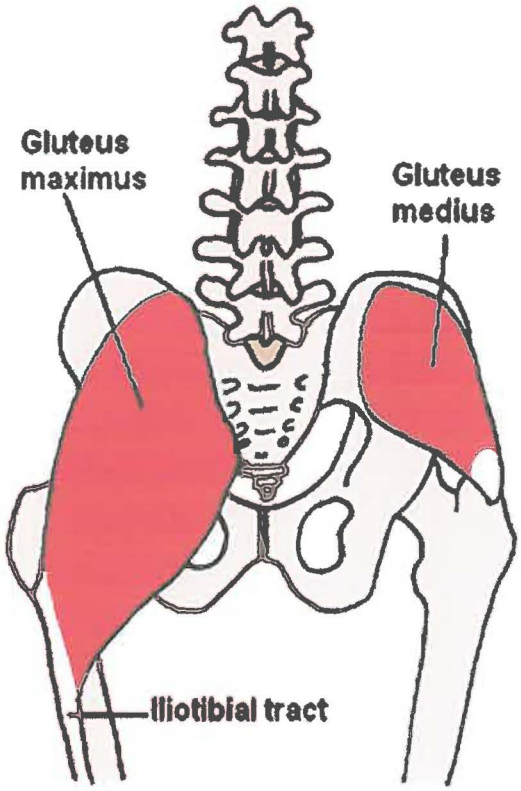
- Gluteus maximus
- Gluteus medius
- Externus and internus obturators
- Piriformis
- Superior and inferior gemelli

- Quadratus femoris
- Sartorius
- Biceps femoris
- Posas major
- Iliacus
- Obturatorius externus and internus

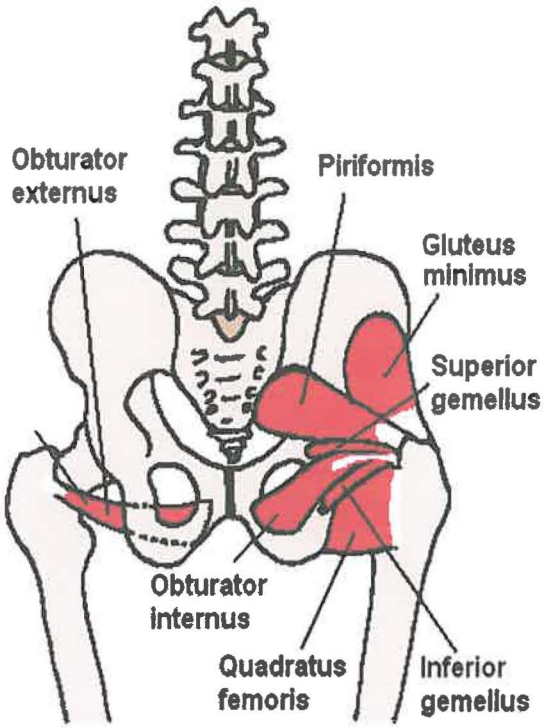
2.3.6 Medial rotator group

- Gluteus minimus
- Gluteus medius
- Tensor fascia lata
- Adductor longus
- Adductor brevis

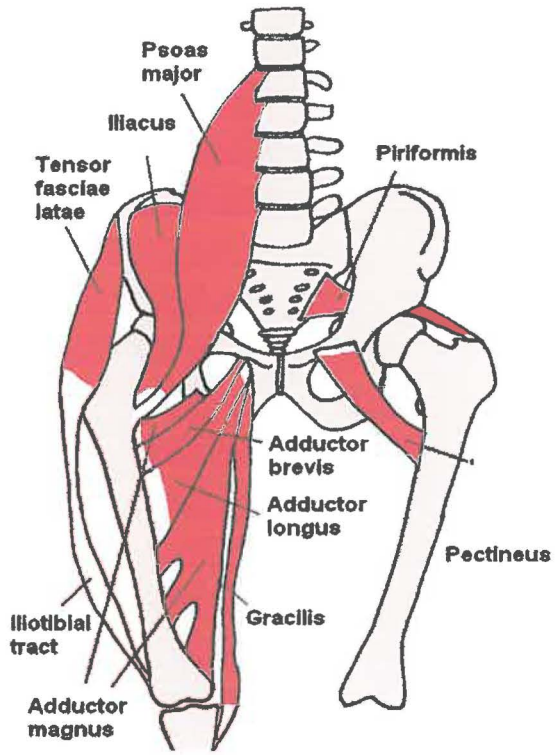
(Moore 1999, Netter 2001, Tortora 2003)



Picture 2. Muscles of the hip joint. (http://en.wikipedia.org/wiki/Hip)



Picture 3. Muscles of the hip joint. (http://en.wikipedia.org/wiki/Hip)



Picture 4. Muscles of the hip joint. (http://en.wikipedia.org/wiki/Hip)

2.4 Hip joint movements

We have six movements in the hip joint:

- Flexion
- Extension
- Abduction
- Adduction
- Lateral rotation
- Medial rotation
- Circumduction

Flexion: occurs as the thigh moves anteriorly and the knee is brought towards the chest.
Extension: the opposite motion. Occurs as the thigh swings posteriorly.
Adduction: pulls the thighs medially (moving thighs together).
Abduction: involves swinging the thigh laterally (moving the knees apart).
Medial rotation: results in the feet pointing medially.
Lateral rotation: the feet would rotate to point laterally.
Circumduction: is a combination of all movements.
(Calais-Germain 1993)

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**
	Adductor Magnus- Posterior	Sciatic	L **3,4**
Adduction	Adductor Longus	Obturator	L **2, 3**,4
	Adductor Brevis	Obturator	L **2, 3**,4
	Adductor 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**
Medial Rotation	Gluteus minimus	Superior Gluteal	L 4, 5, **S 1**
	Tensor Fascia Lata	Superior Gluteal	L 4, 5, **S 1**
Lateral 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**
	Superior Gemellus	Nerve to Obturator Internus	L **5 ,S 1, 2**

Inferior Gemellus	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

(Tortora 2003, http://www.upstate.edu/cdb/grossanat/limbs7.shtml)

2.5 Hip Joint Replacement

Joints are formed by the ends of two or more bones connected by tissue called cartilage. Healthy cartilage serves as a protective cushion, allowing smooth, low-friction movement of the joint. If the cartilage becomes damaged by disease or injury, the tissues around the joint become inflamed, causing pain. With time, the cartilage wears away, allowing the rough edges of bone to rub against each other, causing more pain.

When only some of the joint is damaged, a surgeon may be able to repair or replace just the damaged parts. 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. These prostheses are considered medical devices.

(Brawn 2004, http://en.wikipedia.org/wiki/Hip)

2.5.1 Implants

The stem portions of most hip implants are made of titanium- or cobalt/chromium-based alloys, they come in different shapes and degrees of roughness. Cobalt/chromium-based alloys or ceramic materials (aluminium oxide or zirconium oxide) are used in making the ball portions, which are polished smooth to allow easy rotation within the prosthetic socket. The acetabular socket can be made of metal, ultrahigh molecular weight polyethylene, or a combination of polyethylene backed by metal. All together, these components weigh between 14 and 18 ounces, depending on the size needed.

(http://orthoinfo.aaos.org/fact/thr_report.cfm?Thread_ID=271&topcategory=Hip)

The implants are dividend in three categories:

- Cemented
- Uncemented
- Hybrid

Cemented implants are held in place with bone cement. Generally these implants are used in older, less active adults or in people with weaker bones. Recovery is quicker with cemented implants, though they can eventually come loose. Uncemented implants have textured surfaces that allow new bone to grow into the implant, securing it in place. Recovery takes longer, since it takes time for new bone to grow. A hybrid total hip replacement has one component, usually the acetabular socket, inserted without cement, and the other component, usually the femoral stem, inserted with cement. However uncemented implants are less likely to come loose and may be the preferred prosthesis for active people.
(Dandy 2003, Simeonidis 1996)

All the materials used in a total hip replacement have four characteristics in common:

- They are biocompatible, that is, they can function in the body without creating either a local or a systemic rejection response
- They are resistant to corrosion, degradation and wear, so they will retain their strength and shape for a long time. Resistance to wear is particularly significant in maintaining proper joint function and preventing the further destruction of bone due to particulate debris generated as the implant parts move against each other
- They have mechanical properties that duplicate the structures they are intended to replace; for example, they are strong enough to take weightbearing loads, flexible enough to bear stress without breaking and able to move smoothly against each other as required
- They meet the highest standards of fabrication and quality control at a reasonable cost

(Dandy 2003, Way 2003,
http://orthoinfo.aaos.org/fact/thr_report.cfm?Thread_ID=271&topcategory=Hip)

2.5.2 Parts of total hip prosthesis

A total hip prosthesis consists:

- A plastic or ceramic or metal cup that replaces the hip socket (acetabulum)
- A metal or ceramic ball that will replace the fractured femoral head
- A metal stem that is attached to the shaft of the bone to add stability to the prosthesis

If a hemi-arthroplasty is performed, either the femoral head or the hip socket (acetabulum) will be replaced with a prosthetic device.
(Dandy 2003, Way 2003)

2.5.3 Indications for total hip joint replacement

- Hip pain that has failed to respond to conservative therapy (NSAID medication for 6 months or more)
- Hip osteoarthritis or arthritis confirmed by X-ray
- Inability to work, or sleep, or move because of hip pain
- Loose hip prosthesis
- Some hip fractures
- Hip joint tumors

(Dandy 2003, Way 2003)

2.5.4 This surgery is not recommended for

- Current hip infection
- Poor skin coverage around hip
- Paralysis of the quadriceps muscles
- Severe disease of the blood vessels of the leg and foot (peripheral vascular disease)
- Nerve disease (neuropathy) affecting the hip
- Severe limiting mental dysfunction
- Serious physical disease (terminal disease, such as metastatic disease)
- Morbid obesity (over 300 lb)

The progressively intense chronic pain together with impairment of daily function including walking, climbing stairs and even arising from a sitting position, eventually become reasons for indication of a total hip replacement. Because replaced hip joints can fail with time, whether and when to perform total hip replacement are not easy decisions, especially in younger patients. Replacement is generally considered after pain becomes so severe that it impedes normal function despite use of anti-inflammatory and/or pain medications. A total hip joint replacement is an elective procedure, which means that it is an option selected among other alternatives. It is a decision which is made with an understanding of the potential risks and benefits.
(http://www.medicinenet.com/total_hip_replacement/page2.htm)

2.5.5 Risks of total hip replacement

The risks of total hip replacement include blood clots in the lower extremities that can travel to the lungs (pulmonary embolism). Severe cases of pulmonary embolism are rare, but can cause respiratory failure and shock. Other problems include difficulty with urination, local skin or joint infection, fracture of the bone during and after surgery, scarring and limitation of motion of the hip, and loosening of the prosthesis which eventually leads to prosthesis failure. Because total hip joint replacement requires anesthesia, the usual risks of anesthesia apply and include heart arrhythmias, liver toxicity, and pneumonia. Changed length in legs. Some patients find that the operated leg remains slightly longer than the other leg even after recovery.
(http://www.medicinenet.com/total_hip_replacement/page2.htm)

2.5.6 Prognosis

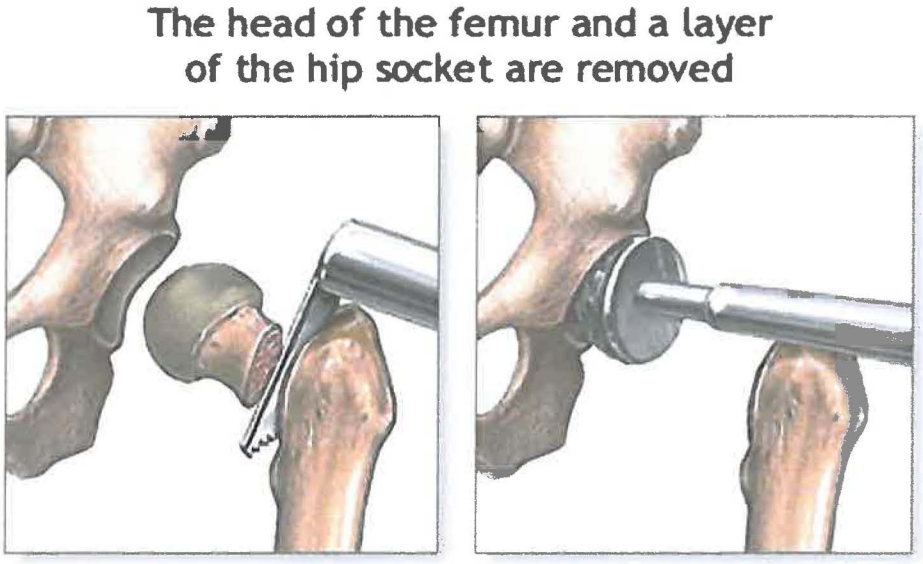
Most patients (80-90%) after total hip joint replacement are relieved from pain and stiffness of hip joint and need no help with walking. The use of crutches will be necessary for as long as 3 months, although most people who did not use them before are able to walk without them in several weeks. With time, sometimes as long as 20 years, the artificial joint will loosen and revision surgery will become necessary.
(Simeonidis 1996)

2.5.7 Surgical approach

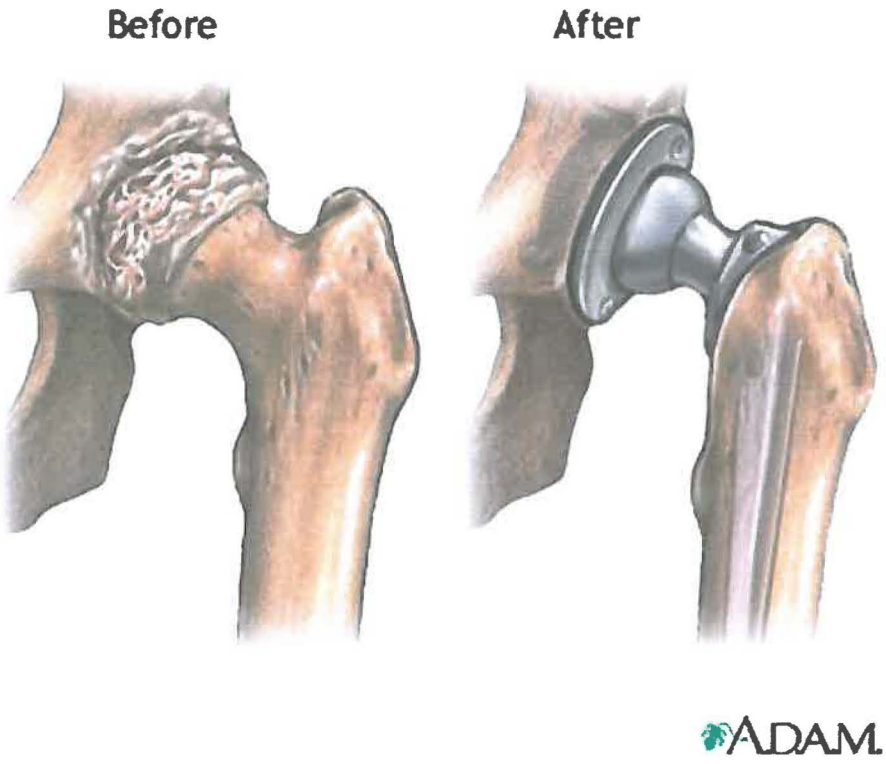
The surgery is performed using general or spinal anesthesia. The orthopedic surgeon makes an incision along the affected hip joint over the buttock or from the side, or from the anterior side exposing the hip joint. The head of the femur and the cup are cut out and removed. Then, the hip socket is cleaned 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 a special cement witch 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 cemented 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.

(Dandy 2003, Simeonidis 1996, Way 2003)



Picture 5. Surgical approach for total hip joint replacement.
(http://adam.about.com/surgery/100006.htm)



Picture 6. Diseased hip joint before and after total hip joint replacement.
(http://adam.about.com/surgery/100006.htm)

2.5.8 Contraindicated movements

- Adduction of hip joint. No crossing of legs or ankles even when sitting, standing, or lying. During sitting, the feet must be about 6 inches apart
- Flexion over 90 degrees of hip joint. During sitting, the knees must be below the level of the hips. Chairs that are too low should be avoided. Bending over at the waist should be avoided
- External and internal rotation of hip joint

2.5.9 Pre operation care

The preoperation care for a patient who is indicated for a total hip replacement includes:

- Condition exercises for cardiorespiratory system
- Stregthening the muscles around the diseased hip
- Teach patient how to walk with crutches

2.5.10 Post operational care of the patient

2. 5. 10.1 Examination techniques

- Range of motion examination (R.O.M.). Active and passive
- Muscle strength testing
- Soft tissue examination
- Walking examination
- Joint play examination
- Muscle length testing
- Anthropometrical measurements
- Neurological examination

2.5.10.1.1 Range of motion examination

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 attaint actively.

The evaluation technique of measuring the range of motion in a joint is called goniometry. When we evaluate range of motion in a joint by goniometry we determine either the particular position of the joint or the total amount of motion existing in the joint in certain circumstances.

The instruments used for measuring the joint range of motion are called goniometers. The most common universal goniometers are durable, washable and can be applied to almost all joints. The goniometer is basically a body with two long arms. One arm is considered movable and the other stationary. The stationary is fixed with body segments and moving arm with moved segments. The basic position of the body which is equal to the anatomical position is the position of reference. The position of each joint in the basic position is zero position. Goniometry measures the portion of motion beyond the zero position. The most common measuring method is based on 0-180 degree scale.

Principles taking the measurements:

- We must maintain the starting position throughout the whole time
- We place axis of goniometer on the place of axis of measured movement
- We provide fixation of the proximal joint segment
- The moving arm is aligned parallel and lateral to the long axis of the moving body segment and stationary arm parallel and lateral to the fixed body segment

- The body part which is being evaluated should be naked
- We measure passive and active range of motion to determine differences
- The next measurement should be done under the same circumstances

Contraindications of measuring the range of motion in a joint:

- Taking measurements in regions affected by dislocation or fracture
- Taking measurements in regions which are immediately after surgical operations on muscles, tendons, ligaments or capsules

(Kendall 1993, Jalovcova M. lectures, "*Examination and Basic Therapeutic Method*", 2003)

2.5.10.1.2 Muscle strength testing

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 fibbers involved in the contraction
- The degree of muscle length
- Gender
- Age
- Specific loading of the muscle to the person's work or activity

The method we use is a subjective method (manual muscle strength testing) and is an important tool for the diagnosis, the prognosis and the treatment of musculoskeletal disorders. The muscle strength testing is an attempt to determine the subject's ability to contract a muscle group voluntarily. That means standard manual muscle strength testing is not suitable for people who cannot actively or voluntary control the tension developed in their muscles.

Grading of muscle strength testing:

- O (no contraction)
- 1 (trace of contraction)
- 2 (moves if gravity is eliminated)
- 3 (moves against gravity)
- 4 (moves against gravity with some resistance)
- 5 (moves against gravity with full resistance)

Basic rules of procedure by Kendall:

- We must keep standard testing procedure
- We must place the patient in a position that offers the best fixation of the body as a whole
- We must provide fixation of the part proximal to the tested one or some other part of the body which is necessary to be stabilized to reach accuracy in testing
- We must place the part to be tested in precise antigravity test position
- If the test movement is used it should be performed with constant speed through the full range of motion
- We must apply the pressure directly opposite to the line of pull of the muscle or muscle segment being tested. The pressure should be uniform and applied gradually
- We should use a long lever whenever possible but not over two joints, and if the muscles do not provide sufficient fixation we should use a short lever instead
- We should use examining table which offers the necessary support
- The next muscle strength test should be done under the same circumstances in order to be more accurate

(Kendall 1993, Jalovcova M. lectures, "*Examination and Basic Therapeutic Method*", 2003)

2.5.10.1.3 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, or resistance to pressure, or moisture, or smoothness or roughness of skin and tissue mobility. We may want to palpate the shape of a structure, the transition of a muscle to tendon or where the tendon is attached. Then we may want to palpate the relative mobility of soft tissue structures one against each other: skin against muscle, muscles and facia against bone.
(Liebenson 1996)

2.5.10.1.4 Walking examination

A lot of factors can cause some deviations in the normal pattern of walking. Some of these factors are:

- Restriction in joint motion (including contractures)
- Pain with movement or weight bearing
- Muscle weakness
- Changes in sensation
- Luck of coordinated movement

(Sinaki 1993)

2.5.10.1.5 Joint play examination (by Mennell)

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 and the direction of the movement depends on the joints anatomical shape.

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, angylosis, acute injures, progressive polyarthritis, swollen joint, painful joint.

(Holubářová J. lectures, "*Manual Methods in Physiotherapy*", 2004)

2.5.10.1.6 Muscle length testing

This examination is done for the purpose of determining whether the range of muscle is:

- Normal
- Limited
- Or excessive

Muscle length test consists of movements that increase the distance between origin and insertion, elongating the muscle in direction opposite to that muscle action.

If the muscle length is limited then we speak about muscle shortness. Muscle shortness can cause limitation in range of motion in a joint. Some muscles generally have the tendency to be shortened.

The grading for shortened muscles (by Janda) is:

- 0- no shortness
- 1-slight shortness
- 2-shortness

(Jalovcova M. lectures, "*Examination and Basic Therapeutic Method*", 2003)

2.5.10.1.7 Anthropometrical 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 information's as feedback in our therapy.

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.

2.5.10.1.8 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.

Some important neurological tests for a patient with total hip replacement are:

- Test for feeling of pain perception
- Perception of temperature
- Two point discrimination
- Light touch

(Springrová I. lectures, "*Physiotherapeutic Methods in Clinical Subjects*", 2004)

2.5.10.2 Therapeutic techniques

- Soft tissue techniques. (Post isometric relaxation of muscles, massage, care of the scar)
- Joint mobilization
- Condition exercises
- Breathing exercises
- Activities of daily living techniques
- Electrotherapy
- Bio-lamp and laser therapy

2.5.10.2.1 Soft tissue techniques

Dysfunction cause increased tension in various structures (tissues) of the motor system and this tension relates to pain. 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.
(Liebenson 1996)

2.5.10.2.2 Joint mobilization

Is a technique which uses small rhythmic repeated movements, in the sense of joint play after reaching the barrier. We repeat it for ten to fifteen times. After application of this technique on a blockade joint we restore the physiological joint play and the functional movement is better.
(Holubářová J. lectures, "*Manual Methods in Physiotherapy*", 2004)

2.5.10.2.3 Condition exercises

Condition exercises are important for:

- Increasing circulation of blood
- Improving breathing
- Strengthening of the weak muscles
- Maintain the normal range of motion in the other joints
- Prevention of oedema on extremities

This can be achieved by active or passive movements. Active movements are very important in the post operative care of a patient with a hip joint replacement. All the muscles around the operated joint have the tendency to hypotrophy after the operation. In order to have better fixation of the replaced joint and the patient to feel more stable during walking all the muscles around the joint have to be strengthened. There are many exercises how to strengthen the muscles. Patient can provide active movements of the hip in the permitted directions with

the assistance of the therapist at first and after against resistance. The contractions of the muscles can be either concentric or eccentric. If muscle are too weak and can't move the extremity then the exercises are performed isometrically. Exercise can be performed also with the help of various exercise balls. Motivation of the patient is very important for physiotherapy exercises, because we need cooperation with her/him. The limited range of motion in a joint can be increased also by passive movements. This movement can be performed by the physiotherapist or a machine. Patient's muscles are relaxed. The movement continues till the pain and it should be performed with a soft stretch. The therapist should follow the reactions of the patient. Hydrotherapy can also used with such patients. Exercising in a swimming pool can help a lot for mobilization of the joints because every movement can be performed without the resistance of gravity.
(http://www.ehealthmd.com/library/totalhipreplacement/THR_recovery.html)

2.5.10.2.4 Breathing exercises

Immediately after the operation the patient is instructed to make some exercises with deep breathing and coughing. These exercises will minimize the risk of any lung complications by removing excess secretions that may settle in the lungs during surgery.

2.5.10.2.5 Activities of daily living techniques

Two or three days after the operation patient should start walking with crutches. In this stage of the treatment is very important the patient to be instructed correctly how to walk by using the crutches. Patient should have his back straight the whole time during walking. First movement is that the crutches go forward. Then follows the operated leg and last the healthy one. One week after the operation patient can walk upstairs or downstairs. When going upstairs first goes the healthy leg, then the operated and last the crutches. When going downstairs, first goes the crutches, then the operated leg and then the healthy. Important note is that with every step should be visible the physiological walking phases.

Patient is also advised to take some special precautions to avoid displacing the joint in the activities of daily living like:

- To avoid crossing of legs or ankles even when sitting, standing, or lying
- When sitting, should keep the feet about 6 inches apart
- When sitting, should keep the knees below the level of the hips. She should avoid chairs that are too low. She may sit on a pillow to keep the hips higher than the knees
- When getting up from a chair, slide's toward the edge of the chair and then use's her crutches for support
- Avoid bending over at the waist. She may consider purchasing a long-handled shoehorn or a sock aid to help her put on and take off her shoes and socks without bending over. Also, an extension "reacher" or "grabber" may be helpful for picking up objects that are too low for her to reach
- When she is lying in bed, to place a pillow between her legs to keep the joint in proper alignment
- A special abductor pillow or splint may be used to keep the hip in correct alignment
- An elevated toilet seat may be necessary to keep the knees lower than the hips when sitting on the toilet
- If she uses a bath tab she has to use a support like a sitting platform

(http://www.ehealthmd.com/library/totalhipreplacement/THR_recovery.html)

2.5.10.2.6 Electrotherapy

Application of electro analgesic currents is good after the operation to relieve the patient from pain. The most often used types of analgetic currents are:

- Diadynamic current for long period
- Middle frequency currents (interference current, transcutaneus electrostimulation, Trabert´s current)

2.5.10.2.7 Bio-lamp and laser therapy

Bio-lamp and laser is a type of phototherapy. They are both polarized light. Main effects of their application are:

- Bio stimulation
- Analgesia
- Anti-inflammatory effects

Indications are:

- Scar tissues
- Skin diseases
- Degenerative diseases
- Post traumatic stages
- Rheumatology diseases
- Neurology disorders

3. Special part

3.1 Patient's protocol

Name

Cunatova Milada.

Year of birth

6-7-1942

Diagnosis

Total hip joint replacement in left side. Coxarthrosis.

Hospitalization

From: 30-01-2006.

To: 14-02-2006.

Operation was on 18-01-2006 in Motol hospital.

Anamnesis

She didn't have the physiological childhood diseases. She has hypertension, ischemic heart disease and diabetes mellitus. She had a brain stroke, carcinoma, heart attack, tuberculosis and glaucoma.

Social anamnesis

She is married and she lives in the fourth floor whithout elevator. She doesn't smoke, she only drinks alkohol in special occasions and she has coffee once per day

Family anamnesis

Her father commided suicide when he was 43 years old. Her mother died from leukemia when she was 40 years old.

Operations

Total hip joint replacement right side in 1994 for coxarthrosis.

Allergies

Plaster.

Pharmacology

Cikanol 1-0-1, Vessel Duel-0-1.

Subjective feeling of patient

She has no pain and she feels a lot of improvement with the movement.

3.2 Initial kinesiological examination

The examination was 12 days after the operation on 30-01-2006 in Malvazinky clinic.

3.2.1 Palpation

Scar was generally released and good healed. Muscle iliopsoas and group of adductors of hip was slight hypertonus.

3.2.2 Anthropometrical measurement

Anatomical length of legs:

- Right 79cm
- Left 79,5cm

Functional length of legs:

- Right 89cm
- Left 89,5cm

Circumference of thigh. (15cm above knee):

- Right 54cm
- Left 52cm

Circumference of calf:

- Right 38cm
- Left 37cm

3.2.3 Active range of motion examination

Hip Joint	Right	Left
Flexion	90°	70°
Extension	10°	5°
Abduction	35°	20°
Knee Joint	Right	Left
Flexion	110°	80°
Extension	0°	0°

3.2.4 Passive range of motion examination

Hip Joint	Right	Left
Flexion	95°	85°
Extension	10°	5°
Abduction	45°	30°
Knee Joint	Right	Left
Flexion	115°	90°
Extension	0°	0°

3.2.5 Muscle strength testing

Muscles	Right	Left
Gluteus_maximus	4	3-
Abductors	4 -	3-
Adductors, performed at neutral position	3+	3+
Quadriceps_femoris	4+	3+
Hamstrings	4+	3+
Ankle plantar flexors	4+	4-
Tibialis anterior	4-	3+

3.2.6 Muscle length testing

Adductors:

- Right- no shortness
- Left- no shortness

3.2.7 Joint play examination

Lisfranc joint left side: dorso-caudal direction was slightly restricted.
Chopart joint left side: dorso-caudal direction was slightly restricted.

3.2.8 Walking examination

There was changed of walking pattern. The patient was walking on tips of toes on operated leg and with elevation of the pelvis in the operated side. The whole time during walking she was bending forward.

3.2.9 Neurological examination

- Sensation in dermatomes along the legs was present. (Pain perception, perception of temperature, two point discrimination, light touch)
- Slight hypaesthesia around the scar

3.3 Result of examination

- Weakness of muscles (Gluteus maximus, abductors, adductors, quadriceps femoris, hamstrings, ankle plantar flexors, tibialis anterior)
- Decreased range of motion in hip and knee joint in the operated side
- Hyper tonus of flexors and adductors muscles of the operated hip
- The scar was slightly restricted
- Incorrect walking

3.4 Hypothesis

We must do mobilization of the scar using soft tissue techniques. Then we need to increase the range of motion by passive and active movements at first and then after some therapies we can make exercises. We need to strengthen the weak muscles by active movements and exercises. We must teach patient how to walk correctly with the crutches.

3.5 Short term rehabilitation plan

- Increase range of motion by passive and active movements, with overball exercises and with exercises of hip without full bearing in the swimming pool (hydrotherapy)
- Strengthen the weakened muscles of operated leg with active assisted movements at first and the by active movements. Also by doing exercises with the overball and using the rotoped
- Increase general circulation of lower extremities by active movements on lower and upper extremities
- Teach patient how to walk correct using the crutches
- Relax the hypertonic muscles by post-isometric relaxation.
- Mobilization of the scar by soft tissue techniques
- Advice patient about the contraindicated movements

3.6 Long term rehabilitation plan

- Help patient to gain his independence by good functioning of the operated leg
- Increase the range of motion of operated leg so that the patient can be adapted with the activities of daily living

Day 1

- Deep abdominal breathing combined with flexion of the arms during exhalation actively the patient contract the abdominal muscles
- Quickly performed dorsal and plantar flexion of both ankles for increasing circulation on lower extremities
- Circumduction of both shoulders simultaneously to maintain the normal range of motion in shoulder joints
- Soft tissue techniques on the scar to mobilize it
- Strengthening of abductors on left leg in supine position. The movement was performed active assisted. There was slight synkinesis of the pelvis during this movement
- Strengthen of flexors of the hip in supine and sitting position. In supine position patient was providing flexion of hip with flexion in knee joint and the heel was sliding on the surface of the bed. In sitting position patient was providing extension of knee against gravity
- Strengthen extensors of the hip in supine position. Patient provided flexion in knees and then she elevates the pelvis. The elevation of the pelvis was not so big
- Post-isometric relaxation techniques for quadriceps femoris in sitting position. Patient has the knee flexed until the end position and pushes into extension against the minimum resistance.
- Passive movement of the hip to flexion and abduction
- Joint mobilization on left Lisfranc and Chopart joints
- Teach patient to walk correctly without loading on the operated leg. She uses the axillary crutches
- Advice patient about the contraindicated movements in order to avoid any dislocation of the operated hip
- Camoped for 20 minutes twice per day to increase range of motion
- Bio lamp for the better healing of the scar- 10 minutes
- Hydrotherapy. Exercises in the swimming pool without bearing on operated leg for 30 minutes to increase the mobility of the hip joint
- Electrotherapy. Analgetic current to relieve patient from the pain

Day 2

- Deep abdominal breathing combined with flexion of the arms and during exhalation actively the patient contract the abdominal muscles
- Quickly performed dorsal and plantar flexion of both ankles for increasing circulation on lower extremities
- Circumduction of both shoulders simultaneously to maintain the normal range of motion in shoulder joints
- Soft tissue techniques on the scar to mobilize it
- Strengthening of abductors on left leg in supine position. The movement was performed active assisted. There was no synkinesis of pelvis
- Strengthen of flexors of the hip in supine and sitting position
- Strengthen extensors of the hip in supine position
- Post-isometric relaxation techniques for quadriceps femuris in sitting position
- Passive movement of the hip to flexion and abduction
- Teach patient to walk correctly without loading on the operated leg
- Camoped for 20 minutes twice per day to increase range of motion
- Laser therapy for the better healing of the scar
- Hydrotherapy for 30 minutes
- Electrotherapy

Day 3

- Deep abdominal breathing combined with flexion of the arms and during exhalation actively the patient contract the abdominal muscles
- Quickly performed dorsal and plantar flexion of both ankles
- Strengthen exercises for left tibialis anterior in supine position
- Circumduction of both shoulders simultaneously
- Soft tissue techniques on the scar
- Strengthening of abductors on left leg. The movement was performed actively
- Strengthen of flexors of the hip in supine and sitting position
- Strengthen extensors of the hip in supine and prone position
- Post-isometric relaxation techniques for quadriceps femoris
- Passive movement of the hip to flexion and abduction
- Teach patient to walk correctly without loading the operated leg on stairs

- Camoped for 20 minutes twice per day to increase range of motion
- Laser therapy for the healing of the scar
- Hydrotherapy for 30 minutes
- Electrotherapy

Day 4

- Deep abdominal breathing combined with flexion of the arms and during exhalation actively the patient contract the abdominal muscles
- Quickly performed dorsal and plantar flexion of both ankles
- Strengthen exercises for left tibialis anterior in supine position
- Circumduction of both shoulders simultaneously
- Soft tissue techniques on the scar
- Strengthening of abductors of legs with resistance of thera- band
- Strengthen of flexors of the hip in supine and sitting position
- Strengthen extensors of the hip in supine and prone position
- Passive movement of the hip to flexion and abduction
- Teach patient to walk correctly. Downstairs and upstairs
- Rotoped for 20 minutes twice per day to increase range of motion
- Bio-lamp therapy for healing of the scar
- Hydrotherapy
- Electrotherapy

Day 5

- Deep abdominal breathing combined with flexion of the arms and during exhalation actively the patient contract the abdominal muscles
- Quickly performed dorsal and plantar flexion of both ankles
- Strengthen exercises for left tibialis anterior in supine position
- Circumduction of both shoulders simultaneously
- Soft tissue techniques on the scar
- Strengthening of abductors of the legs with resistance of thera-band
- Strengthen of flexors of the hip in supine and sitting position. In supine we used overball and patient gave slight pressure on the operated leg
- Strengthen extensors of the hip in supine and prone position

- Passive movement of the hip to flexion and abduction
- Walk with patient downstairs and upstairs
- Rotoped for 20 minutes twice per day
- Laser therapy for the scar
- Hydrotherapy
- Electrotherapy

Day 6

- Strengthen exercises for left tibialis anterior in supine position
- Soft tissue techniques on the scar
- Strengthening of abductors of the legs with resistance of thera-band
- Strengthen of flexors of the hip in supine and sitting position. In supine we used overball and patient gave slight pressure on the operated leg
- Strengthen extensors of the hip in supine and prone position
- Passive movement of the hip to flexion and abduction
- Walk with patient downstairs and upstairs. Patient was instructed to load slightly the operated leg during walking
- Rotoped for 20 minutes twice per day
- Laser therapy for the scar
- Hydrotherapy
- Electrotherapy

Day 7

- Various strengthen exercises for the flexors, extensors and abductors of hip. Overball and thera-band were used with the exercises
- Soft tissue techniques on the scar
- Walk with patient downstairs and upstairs. Correction of the foot action during walking
- Rotoped for 20 minutes twice per day
- Laser therapy for the scar
- Hydrotherapy
- Electrotherapy

Day 8

- Various strengthen exercises for the flexors, extensors and abductors of hip. Overball and thera-band were used with the exercises
- Soft tissue techniques on the scar
- Post-isometric relaxation techniques for left quadriceps femoris
- Walk with patient downstairs and upstairs
- Rotoped for 20 minutes twice per day
- Bio-lamp therapy for the scar
- Hydrotherapy
- Electrotherapy

Day 9

- Various strengthen exercises for the flexors, extensors and abductors of hip. Overball and thera-band were used with the exercises
- Soft tissue techniques on the scar
- Post-isometric relaxation techniques for right triceps sure
- Walk with patient downstairs and upstairs
- Rotoped for 20 minutes twice per day
- Laser therapy for the scar
- Hydrotherapy
- Electrotherapy

Day 10

- Strengthen exercises for the flexors, extensors and abductors of hip. Overball and thera-band were used with the exercises
- Soft tissue techniques on the scar
- Post-isometric relaxation techniques for left quadriceps femoris
- Walk with patient downstairs and upstairs
- Rotoped for 20 minutes twice per day
- Laser therapy for the scar
- Hydrotherapy
- Electrotherapy

3.7 Final kinesiological examination

3.7.1 Palpation

Scar was generally released and good healed. I found slight hypertonic the left quadriceps.

3.7.2 Anthropometrical measurement

Circumference of thigh. (15cm above knee):

- Right 55cm
- Left 54cm

Circumference of calf:

- Right 38cm
- Left 37cm

3.7.3 Active range of motion examination

Hip Joint	Right	Left
Flexion	90°	90°
Extension	10°	10°
Abduction	35°	30°
Knee Joint	Right	Left
Flexion	110°	95°
Extension	0°	0°

3.7.4 Passive range of motion examination

Hip Joint	Right	Left
Flexion	95°	90°
Extension	10°	10°
Abduction	45°	40°
Knee Joint	Right	Left
Flexion	115°	110°
Extension	0°	0°

3.7.5 Muscle strength testing

Muscles	Right	Left
Gluteus_maximus	4	4
Abductors	4 -	4
Adductors	3+	3+
Quadriceps_femoris	4+	4+
Hamstrings	4+	4
Ankle plantar flexors	4+	4
Tibialis anterior	4-	4

3.7.6 Walking examination

Patient during walking with the axillary crutches had her back straight and she was following a correct walking pattern as she was taught during physiotherapy.

3.8 Therapy proposal

Patient should continue exercising at home by the help of thera-band or overball or by active exercises in order to strengthen more the muscles of the operated leg and increase the range of motion.

3.9 Prognosis

The patient is able to do all the daily activities with the help of crutches. I assume that if she continues exercising, in three months after the physician's recommendation she could walk and adapt to the activities of daily living without using the crutches.

4. Conclusion

During the first contact with the patient I noticed slight anxiety which was reduced in the following therapeutic sessions. The fact that the patient was able to relax allowed a better cooperation with me, and as a result, the entire exercise program was more effective. The good psychology of the patient played a very important role to the quick recovery.
It is obvious that after two weeks of intense rehabilitation the patient's condition was rapidly improved. For better post operation treatment good knowledge around this field is required from the physiotherapist.

List of abbreviations

- NSAID: non steroidal anti inflammatory drugs
- ROM: range of motion

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