Charles University in Prague
Faculty of Physical Education & Sports
Department of Physical Therapy

Bachelor Degree Thesis in Physical Therapy

Case study of Physical Therapy approach of patient with bilateral coxarthrosis after surgical operation of total hip replacement

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Prague, Czech Republic 2012

Abstract

Title: Bachelor thesis concerning the application of therapeutic methods as a part of Physical Therapy program in a patient after the undergone of the surgical operation of total hip replacement.

Název bakalářské práce: **Fyzioterapeutické postupy u pacienta po totální náhradě kyčelního kloubu**

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The particular Bachelor Thesis analyzes the therapeutic approach of a patient after the undergone of the surgical operation of total hip replacement. The therapeutic procedures and the aspects/results of it are explained in depth in a theoretical and practical part.
In the theoretical part the degenerative disease of coxarthrosis is described as well the anatomy of the associated area, the examinations and therapeutic procedures that are performed by the physiotherapist and the physician. Since the patient has undergone a surgical operation of total hip replacement, there will be reference to the surgical procedure, the principles and the complications that may occur. The practical part of the thesis will be primarily consisted by the narration of all the examinations and therapeutic procedures that I provided in a patient who was after the surgical operation of total hip replacement.

The patient I worked with was a sixty-five (65) years old lady, who was presenting coxarthrosis bilaterally and undergone the surgical operation of total hip replacement. The surgical operation took place nearly three months before the practice begun, more specifically on the 28th of October of the previous year (2011).
The practice took place on the military hospital of Prague U.V.N (Ústřední vojenská nemocnice Praha 1200/1, 162 00 Praha 6) the second half of the month January (16.1.2012→27.1.2012) during which period of time I consulted the particular patient six times.

Keywords: Physiotherapy treatment, hip joint, fracture of femoral neck, coxarthrosis, total hip replacement

Declaration

I declare that this Bachelor Thesis was structured based on the research I made the last couple of months. During the writing of the Bachelor thesis there was no violation of the rules and instructions that were given by the department of Physical Therapy of Charles University in Prague.
During the performance of my Bachelor Thesis Practice in the military hospital of Prague (Ústřední vojenská nemocnice Praha 1200/1, 162 00 Praha 6) no invasive methods were used. I acted based on my knowledge that I got through my three-year studying, and always with respect to the patient and the physiology of the condition.
The patient that I choose for the Bachelor Thesis was fully aware that the examination and the therapeutic procedures that were going to take place would later used to support the writing of this Bachelor Thesis. Also proposed informed consent was assigned by the patient (Informovany Souhlas).
My work was supervised by Mgr. Zuzana Sekaninova, from the department of Physical Therapy and Rehabilitation of U.V.N and by Mgr. Klara Hojkova of the department of the Physical Education and Sports of Charles University.

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Acknowledgments

I remember it was around the mid of October 2009 when we gathered, me and my colleagues, in order to take our oath as physiotherapy students of Charles University. Now the year 2012 that long journey is coming to an end. I believe that there is a big difference between the person that I was three years ago and the person I am right now. Prague, the Charles University, the people I met here and I shared experiences with, all those factors helped me to carve the person I am today.

So without further delay I would like to say a big “thank you” to Prague that gave me accommodation, I would like to thank Charles University for providing me the opportunity to study Physiotherapy, and of course all the professors of the faculty that shared with me and my colleagues generously their knowledge and personal experience. From now on, I will use the knowledge that I got those years, in my occupation and I will also try my best to improve that knowledge and become a better physiotherapist and a better person.

I would like to say a big “thank you” to my supervisor Mgr. Klara Hojkova for her guidance and patience and to my supervisor on the U.V.N military hospital of Prague Mgr. Zuzana Sekaninova for her assistance on my Bachelor Thesis Clinical Practice.

I would like to thank the physiotherapists Kaiti Gourdi, Vasilis Giourelis and Ilias Veselemes, that accepted me to work under their supervision and the knowledge that they generously gave me during my summer clinical practice course. I would like to say a generous “thank you” to the person that gave me courage by revealing to me how important physical therapy is nowadays, Manolis Anastopoulos. Up to this day he is the ideal professor to me. He is truly an incredible person that each and every day without exception he is working with love and respect to himself and to the people working with him. Last but not least I couldn’t forget my own family that trusted me and supported me in my effort to become a responsible and valuable person. I would like to say thank you to my mother, Dimitra Papageorgaki, my father, Attalos Nikolaou, my younger sister, Magda Nikolaou and of course my grand-parents Magdalini Poseidou and Georgios Papageorgaki.

Dimitris Nikolaou
Prague 2012

Dedication

I would like to dedicate this Bachelor Thesis, and my whole effort for bringing it together to my grand-parents Magdalini Poseidou and Georgios Papageorgaki. During the absence of my parents for the biggest part of the day, due to their working responsibilities, they were the ones that raised me and gave me ideals and morals so I can be the person I am today and the person I am going to be in the years to come. I will be always grateful and love them.

Dimitris Nikolaou
Prague 2012

Contents

1. Introduction (Preface)

1. Preface

In the particular Bachelor Thesis the topic that is described is the coxarthrosis of the hip joint. The analysis of the given topic includes the Etiology of the malfunction, the examination that took place from the Physician and the Physical Therapist, the associate treatment (conservative and non-conservative), the surgical treatment (before the undergone of the surgical operation and after that – post-operative), the physical therapy program, teaching of self-therapy to the patient, and daily living activities. All the previous considerations were explained during the theoretical part of the Bachelor Thesis.
The practical part (case study) has entirely associated with the therapeutic unit that was applied on the patient and the progress that was succeeded. In particular includes the present state of the patient, anamnesis, previous rehabilitation that was attended, examination, conclusion, proposal of the therapeutic unit, short and long-term rehabilitation plan, day to day session, the results of the therapy that was applied, self-therapy instructions, final kinesiology examination and result of the progress of the therapy.

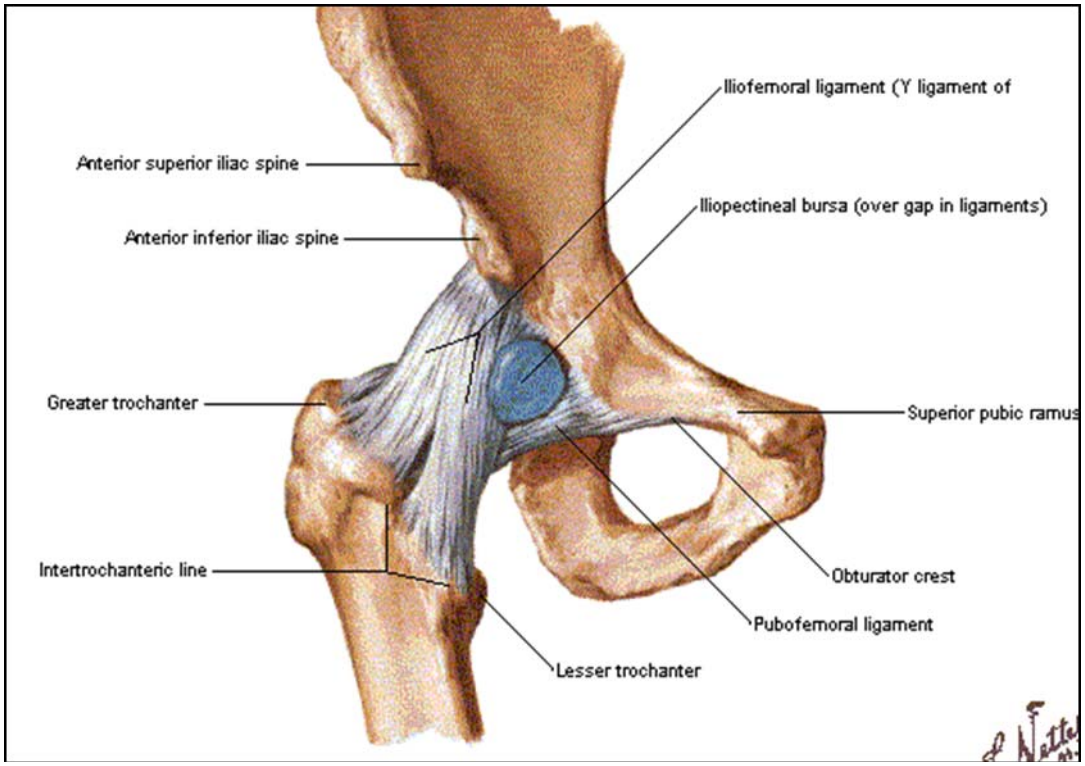
The reader of this particular Bachelor Thesis will get an integrate view on the subject of the coxarthrosis from theoretical and practical point of view.

2. General Part

2.1 Overview of the Hip joint (Coxal Articulation)

Etymology: **L**. coxae + articularis

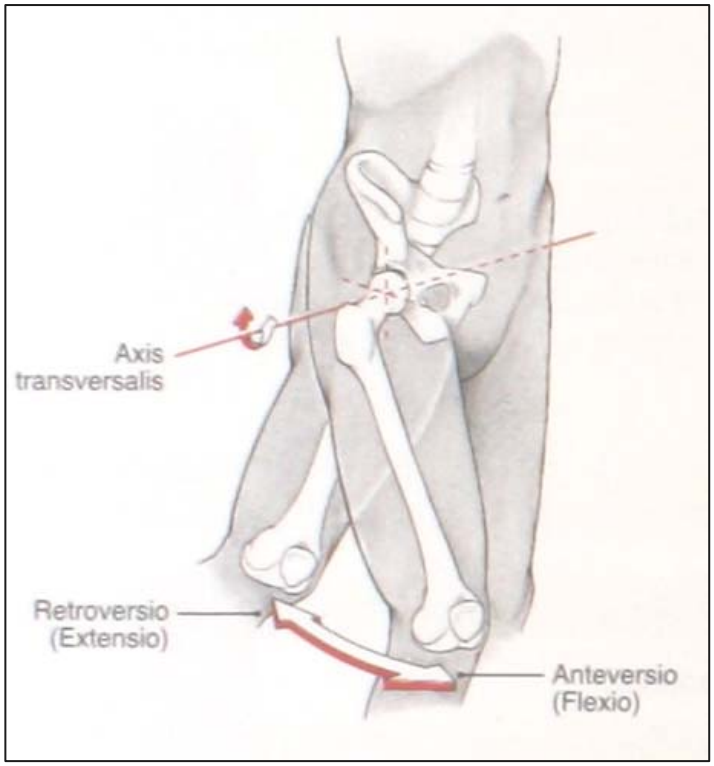
The hip joint can be found in the lower part of the human body, below the middle third of the inguinal ligament and laterally. The hip joint is characterized as a ball-and-socket type of joint. The particular characterization is vindicated as it is formed by the contribution of the spheroid head of the proximal distal part of the femur bone (the ball component) and the cavity of the acetabulum (the socket component). The hip joint is noted for its excessive strength and at the same time providence of such a great range of motion. The hip joint is characterized as a synovial-type of joint. The synovial type of structure wants the two bony edges contributing into the formation of the joint to be separated, be freely moveable, the ends to be covered with articular cartilage, and the existence of synovial fluid. (7 & 25)



Picture no. 01 – Graphical Illustration of the anterior view of the hip joint

2.1.1 Kinesiology of the Hip joint

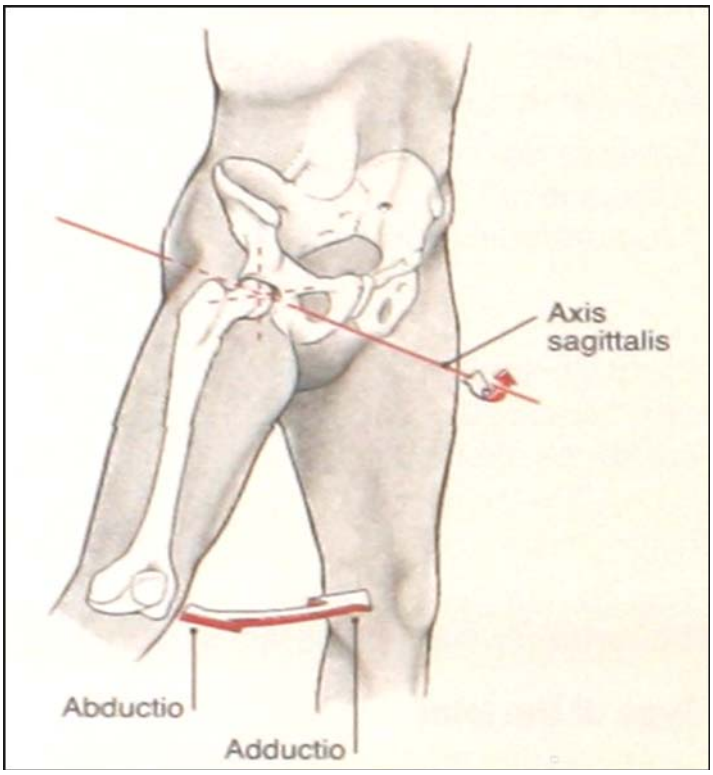
The hip joint is designed in that way that provides stability and weight bearing at the expense of mobility. The hip joint is allowing the performance of the following movements:



- **Flexion and Extension**: Generally flexion is described as the movement during which the angle between two body segments is decreasing. On the other hand extension is described as the movement during which the angle between two body segments is increasing .In the case of the lower extremities, flexion and extension are movements that are performed in the frontal (coronal) axis.

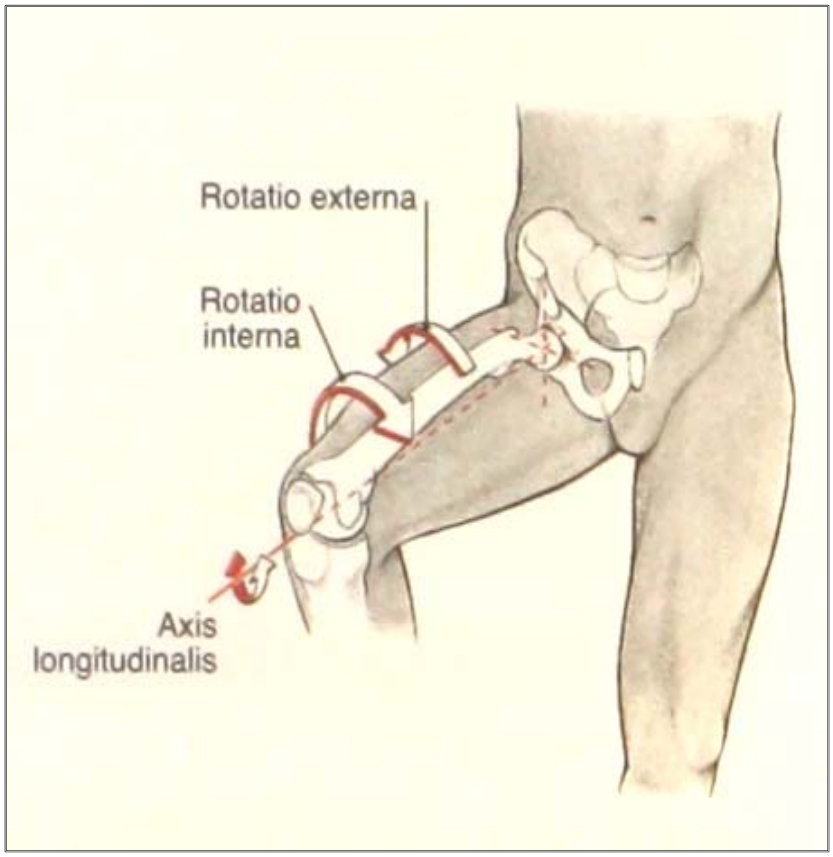
Flexion is performed into anterior direction. The range of flexion that is allowed by the morphology of the hip joint is from zero till approximately 125^0. The extension is the movement into posterior direction. The range of extension that is allowed is from zero till 10^0, making a total range of motion (considering both flexion and extension) of 135^0. (19& 25)

Picture no. 02– Graphic Illustration of the movements of Flexion and Hyper-Extension of lower extremity in the hip joint



- **Abduction and Adduction:** Movements that are performed about the sagittal axis. Abduction is defined the movement during which the associated body segment moves away from the mid-sagittal plane (in lateral direction). The range of abduction is from zero till approximately 45^0. On the other hand the adduction is the movement of the associated body segment towards the mid-sagittal plane (in medial direction). The range of adduction is from zero to 10^0 or 30^0making a total range of approximately $55^0 \rightarrow 75^0$. (19 & 25)

Picture no.03 – Graphic Illustration of the movements of Abduction and Adduction of the lower extremity in the hip joint



- **Lateral (external) and Medial (internal) rotation**: Movements that are performed about a longitudinal axis. The medial rotation, also referred to as internal is the movement during which the anterior aspect of the thigh turns toward the mid-sagittal plane. On the other hand the external rotation, also called lateral is the movement during which the posterior aspect of the thigh moves toward the mid-sagittal plane. The rotation may not be characterized as clearly movement of the hip joint and the lower extremities but also from the movement of the trunk on the femur.(19 & 25)

Picture no. 04 – Graphical Illustration of External/Lateral rotation and Internal/Medial rotation of the lower extremity in the hip joint

2.1.2 Review of the bones of the hip joint

The two most important bones of the associated area of the hip joint are the femur bone and the pelvic bone. The importance of those bones can be understood by the fact that the articulation between those two, the circular head of the femur bone and the cup-like cavity of the pelvic bone are forming the hip joint (7)

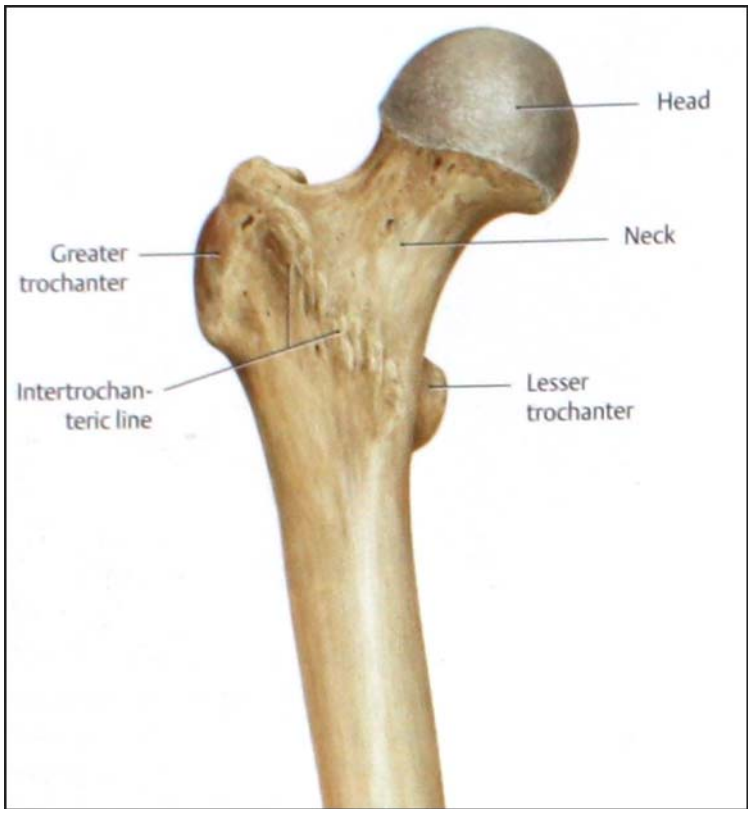
2.1.3 Femur Bone (L. Os Femoris/ Os Longissimum)

The femur bone is the longest, heaviest and strongest bone of the human body and occupies the area of the thigh of the lower extremity. It supports the body's weight during several activities such as: walking, running or standing e.t.c. The general appearance of the femur bone is a proximal and a distal part – with the associated fractures on them and they are connected through a long structure that is called the body (**L**. shaft) of the femur bone. That particular proximal part is the one that comes in contact with the area of the acetabulum of the pelvic bone and forms the hip joint (7)

2.1.4 Important parts of the Femur Bone

Following is a list with the most important aspects of the proximal part of the femur bone. Those parts are either contributing to the formation of the hip joint or give the insertion/origin site for several muscles of the associated area.

- **Head of Femur** (**L**. Caput Femoris): The head of the femur is the proximal round-shaped end of the bone. It is the one of the two main components/structures that make up the hip joint (7)



- **Neck of Femur** (**L**. Collum Femoris): The femoral neck is connecting the head of the femur with the rest of the body/shaft of the bone. Another important to note fact concerning the femoral neck of the femur is that the 99% of the fractures concerning the bone of the femur occur in that particular area. (7)

Picture no. 05 – Graphical Illustration of the proximal end/part of the femur bone– Anterior View

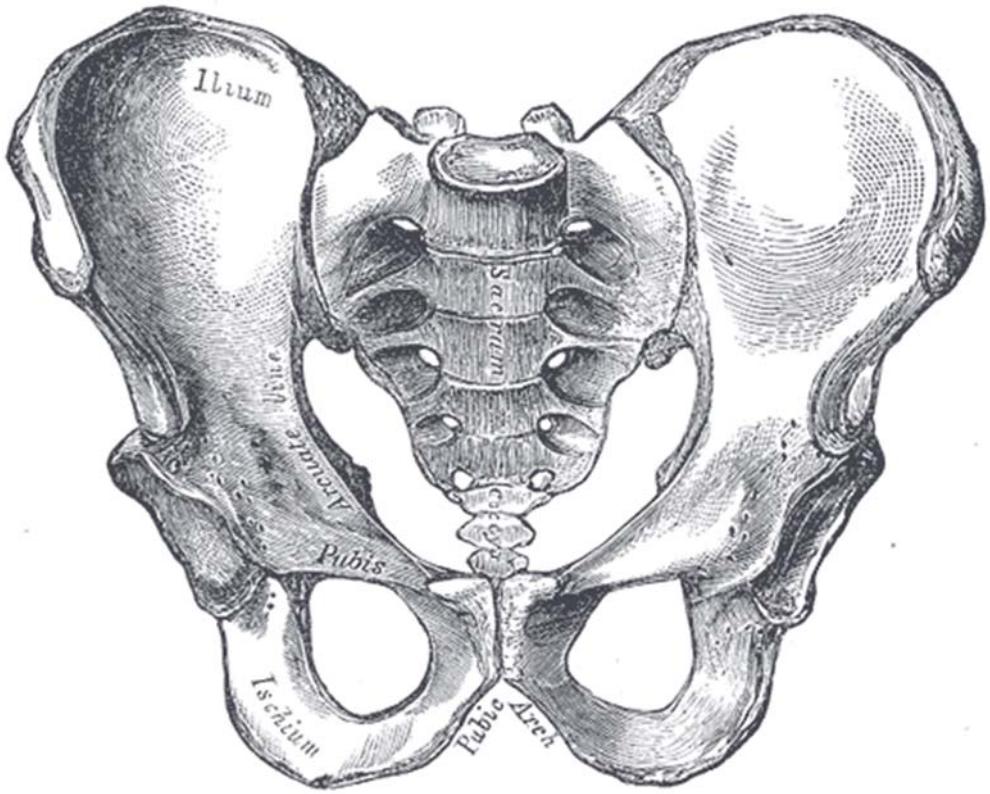
- **Greater Trochanter** (**L.** Trochanter Major): The particular structure is a prominence that is located on the proximal part of the femur bone on the lateral aspect of it. The anterior and posterior aspect of the greater trochanter provides the site of insertion for the muscles gluteus minimus and medius respectively as well for the abductors and stabilizers of the hip joint. (7)
- **Inter-trochanteric line** (**L.** Linea Inter-trochanterica): Superiorly the inter-trochanteric line anchors the iliofemoral ligament (the largest ligament in the human body). (7)
- **Inter-trochanteric crest** (**L**. Crista Inter-trochanterica): Is the elevated line that is located on the posterior aspect of the proximal part of the femur bone right between the greater and the lesser trochanter of the femur bone. (7)

2.1.5 Pelvic Bone (L. Os Pelvis)

The pelvic bone is a complex unit that most of the times is considered as a unit –it's complexity can be compared with the proportional complexity of the skull bone. The reason is that the true shape, orientation and apparently function can't be understood if someone don't consider the pelvic bone as a unit but as individual segments. (7)

2.1.6 Important parts of the pelvic bone

Following is a list with the most important aspects of the pelvic bone. As described in the case of the femur bone in previous section, the associated parts are important for the general function of the hip joint and provide the sites for the origin and insertion of the muscle groups that surround the hip joint. (7)



Picture no. 06 – Graphical Illustration of the pelvic bone (*Anterior View*) – In the particular illustration is outlined the male pelvic bone

- **Pelvic Surface** (**L**. Facies Pelvica): The particular term is used in order to describe any surface that is occupying the area of the pelvic cavity
- **Pelvic Cavity** (**L**. Pelvic Major): It is the site of the human body located below the area of the abdomen. The particular structure is formed by the pelvic bone.
- **Pubic arch (L**. Arch Pubicus): The pubic arch can be found inferior to the pubic symphysis. It is formed by the contribution of the ischiopubic ramus.
- **Greater (or false)**: Is the portion of the pelvis that is located at the area between the linea terminalis and alae of the ilium.
- **Lesser (or true) pelvis**: Is the portion of the pelvic bone that can be found beneath the linea terminalis.
- **Linea Terminalis (L**. Linea Terminalis Pelvis): Is the line that separates the greater and the lesser pelvic portions. The linea terminalis is formed by the following structures: sacral promontory, the arcuate line, the pectineal line, and the pubic crest
- **Iliopectineal Line**: Is a portion of the linea terminalis that is formed by the arcuate line and the pectineal line.
- **Pelvic Inlet (L.** Apertura Pelvic Superior): Is the plane that is defined by the associated linea terminalis. (7)

2.1.7 Ligaments supporting the hip joint

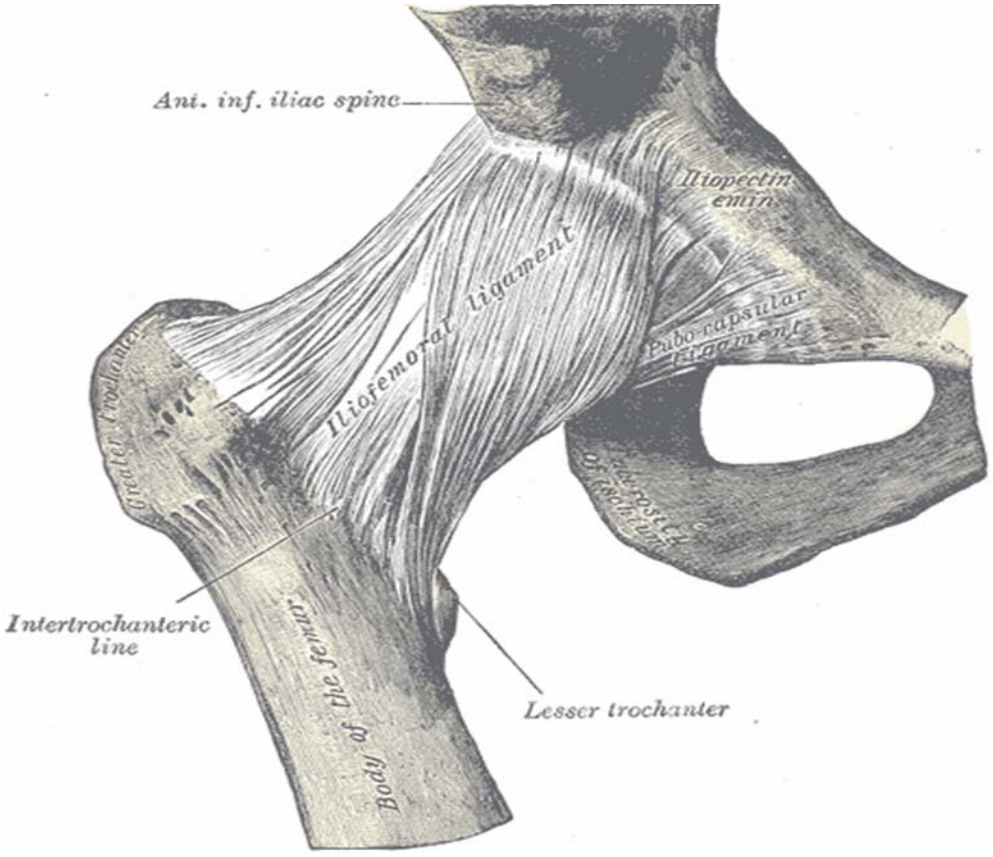
Three ligaments are supporting the hip joint during the performance of the associated movements. The fibers of those ligaments are oriented in that way that they appear in a spiral fashion, embracing the whole hip joint. That way of construction of the hip permits the great mobility of the hip joint while at the same time gives stability and support during the execution of the movements. (10)

- **Iliofemoral Ligament** (**L.** Ligamentum Iliofemorale): it is a triangular shaped ligament that is located on the anterior compartment of the hip joint. It's apex is attached to the lateral side of the iliac bone in the space/area between the anterior inferior iliac spine and the margin of the acetabulum of the pelvic bone. The base of the particular ligament is located along the inter-trochanteric line of the femoral bone. The segments that are located above and below the intertrochanteric line are thicker than the segments on the central compartment of the line. As a result the ligament has a characteristic "Y" shape. (10)

- **Pubofemoral Ligament** (**L.** Ligamentum Pubofemorale): It is located on the anterior-inferior compartment of the hip joint. The pubofemoral ligament presents the same triangular shape that can be found on the iliofemoral ligament. The base of the ligament is attached to the iliopubic eminence, adjacent bone

and obturator membrane. Laterally it blends with the fibrous membrane and with the deep surface of the iliofemoral ligament. (10)

- **Ischiofemoral Ligament** (**L.** Ligamentum Ischiofemorale): the particular ligament is functioning in reinforcing the posterior aspect of the fibrous membrane. The particular ligament is attached to the medial compartment of the ischium, just postero-inferior to the acetabulum of the pelvic bone, and laterally to the greater trochanter of the femur bone. (10)



Picture no. 07– Graphical Illustration of the ligaments of the hip joint – anterior view

2.1.8 Muscle groups surrounding the hip joint

The human hip joint is well constructed in order to support several activities of the individual during his/her daily living such as: walking, climbing the stairs, running e.t.c. Of course the structure is such that permit a great range of movement, but also very important is the contribution of the associated muscle groups of the area of the hip joint. Those muscles are contributing into the movement of the hip joint either by direct or indirect way. The muscles surrounding the hip joint can be divided into muscle groups depending on the function for which they are responsible. (19)
In that way we can distinguish the following muscle groups:

1. **The Flexors group of muscles**: The main flexors of the hip joint are the psoas minor, psoas major and iliacus muscle, better known as one muscle, the iliopsoas muscle. The flexors group of muscles is supplemented by a number of some other muscles that assist into the flexion of the lower extremity in the area of the hip joint e.g. rectus femoris muscle, sartorius. (10 & 19)
2. **The Extensors group of muscles**: The muscles that contribute into the performance of extension of the lower extremity in the area of the hip joint are the hamstring group of muscles and the gluteus maximus muscle. (10 & 19)
3. **The Abductors group of muscles:** The abductor group of muscles is composed by the rest of the gluteal muscles (Gluteus Medius and Gluteus Minimus) as well from the muscle tensor fasciae latae. (10 & 19)

Quadriceps Femoris group of muscles

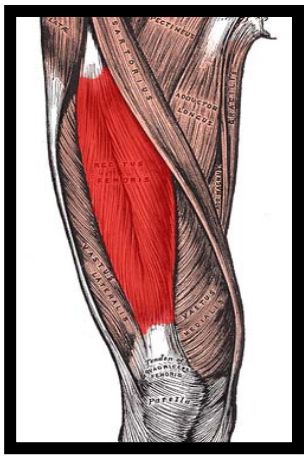
The name derivates from the Italian words "-quadro" and "-ceps" meaning four and head respectively. The quadriceps femoris group of muscles is a very large extensor that occupies the anterior compartment of the thigh of the lower extremity. In summary the quadriceps femoris m. is composed by four muscles:

- Rectus Femoris muscle: Located at the middle of the anterior side of the thigh
- Vastus Medialis muscle: Located on the medial part of the thigh
- Vastus Lateralis muscle: Located respectively on the lateral compartment and
- Vastus Intermedius: Located also on the center of the thigh but beneath rectus femoris (10)

Additional Note

From the quadriceps femoris group of muscles, the only muscle component that has some contribution to the function/movement of the hip joint is the rectus femoris muscle. The other muscle components are mainly contributing into the extension of the lower extremity in the area of the knee joint. But still the quadriceps femoris is a very important muscle for the associated area of the thigh and the hip joint. (19)

Rectus Femoris m. (L. musculus Rectus Femoris)



Origin: Anterior Inferior Iliac Spine / Exterior surface of the bony ridge of the iliac portion forming the acetabulum

Insertion: Into the superior edge of the patella as one of the quadriceps muscles

Nerve: Femoral Nerve (**L**. Nervus Femoralis)

Function: Extension of the lower extremity in the area of the knee joint. The rectus femoris muscle also assists into the flexion of the lower extremity in the area of the hip joint. (10)

Picture no. 08 – Graphical Illustration of the Rectus Femoris muscle

Biomechanical Aspect of the muscle in relation to the hip joint

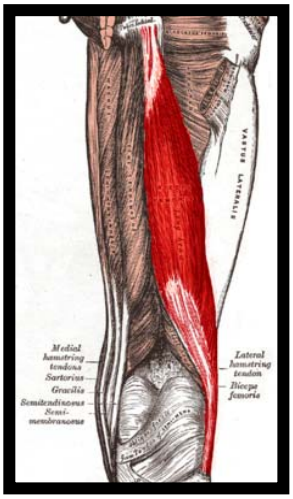
The rectus femoris muscle is characterized as a two joint muscle. That attribution makes the muscle responsible for the extension of the lower extremity in the area of the knee joint and for the flexion of it in the hip joint –assistive function. The rectus femoris is sometimes called the "kicking muscle". The reason for that particular designation is that the muscle is in maximal position for output (for the performance of a kick) when the lower extremity is flexed in the area of the knee joint and the thigh is drawn back in a position of hyper-extension. The particular position enables the muscle to contribute in both the movements that were reported previously. (19)

Hamstrings group of muscles

The hamstrings are the large group of muscles that is located on the posterior compartment of the thigh. As in the case of the quadriceps femoris m., the hamstrings are a composition of individual muscles that function as one. More specifically the muscles that make up the group are:

- Biceps Femoris muscle: Located on the lateral aspect of the dorsal compartment of the thigh
- Semitendinosus muscle**:** Located between the biceps Femoris muscle and the Semimembranosus m.
- Semimembranosus muscle: Is the most medial/internal-placed muscle out of the three that make the hamstrings group. (10)

Biceps Femoris m. (L. musculus Biceps Femoris)



Origin: Ischial tuberosity, linea aspera, and sites of the femoral bone.

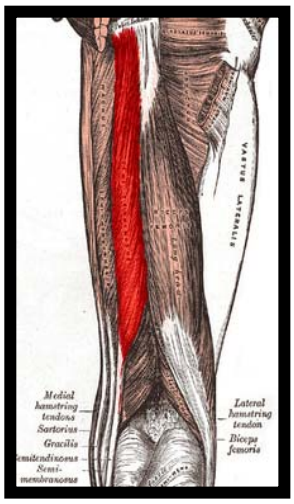
Insertion: Head of the fibulae bone, which articulates with the back of lateral tibial condyle

Nerve: The long head of the muscle is innervated by the tibial nerve (**L**. Nervus Tibialis), while the short one is innervated by the common peroneal nerve (**L**. Nervus Fibularis Communis/Peroneus Communis)

Function: Flexion of the lower extremity in the area of the knee joint – Assist into the lateral/external Rotation of the lower extremity when the knee is flexed (10)

Picture no. 09– Graphical Illustration of the Biceps Femoris muscle

Semitendinosus m. (L. musculus Semitendinosus)



Origin: Ischial tuberosity

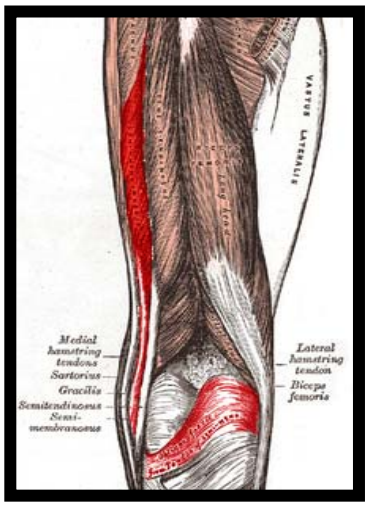
Insertion: Upper shaft of the tibia bone

Nerve: Sciatic nerve (**L**. Nervus Ischiadicus) branches L_5, $S_{1\rightarrow 2}$

Function: Flexion of the lower extremity in the area of the knee joint – Assists into the extension of the lower extremity in the hip joint (10)

Picture no.10- Graphical Illustration of Semitendinosus muscle

Semimembranosus m. (L. musculus Semimembranosus)



Origin: Ischial Tuberosity

Insertion: Posterior portion of the medial condyle of the tibia bone.

Nerve: Sciatic nerve (**L**. Nervus Ischiadicus) branches L_5, $S_{1\text{-}2}$

Function: Flexion of the lower extremity in the area of the knee joint – Assistance into the extension of the lower extremity in the area of the hip joint. (10)

Picture no. 11– Graphical Illustration of the Semimembranosus muscle

Biomechanical Aspect of the muscle in relation to the hip joint

In the following section the description regards the hamstrings as a group of muscles

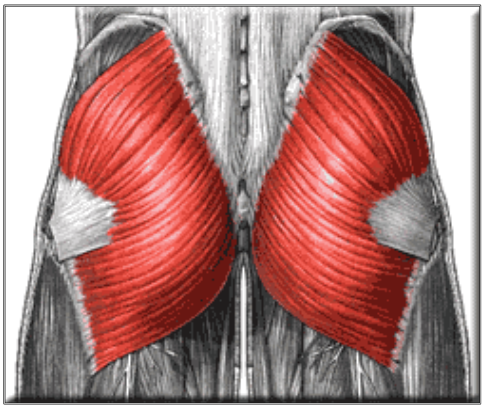
The main contribution during the extension of the lower extremity in the area of the hip joint is provided by the hamstrings group of muscles. The medial muscles (Semitendinosus and Semimembranosus) are not as active as the biceps femoris that is the "source" of the work of the muscle. The hamstrings are crossing the knee joint, thus being able to produce the movements of flexion and rotation of the lower tibia. As a result the effectiveness of the hamstrings as extensors of the hip depends on the position of the knee joint. The hamstrings are responsible for maintaining an upright posture as they are pulling down the pelvic area from the point of the ischial tuberosity, creating a posterior tilt. Loss of power of the associated muscle group leads to a significant impairment of the extension of the hip joint. (19)

Glutei group of muscles

The term “gluteus” comes from the Greek word “glutos” which refers to the area of the buttocks of the human body. Thus the gluteal group of muscles is composed by muscles that can be found on the associated area. Those muscles are:

- Gluteus Maximus: The most superficial muscle of the associated area, covering the rest of the muscles.
- Gluteus Minimum and Medius**:** Those are the deepest muscles of the associated area. Their function is contributing on movement of the lower extremity (10)

Gluteus Maximus m. (L. musculus Gluteus Maximus**)**



Origin: Gluteal surface of ilium, lumbar fasciae, sacral bone, sacrotuberous ligament

Insertion: Gluteal tuberosity of femur bone and iliotibial tract

Nerve: Inferior gluteal nerve - nerve roots: L_5, $S_{1\rightarrow 2}$

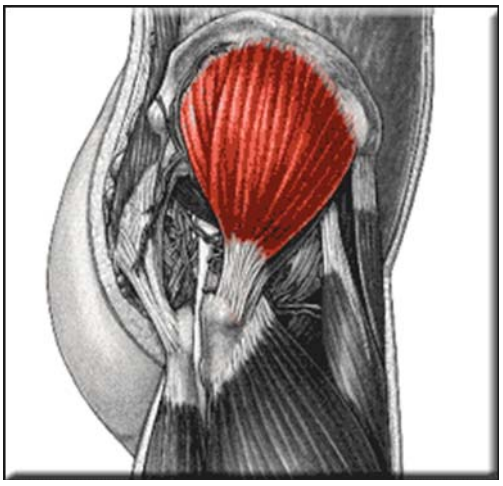
Function: Extension and external rotation of the lower extremity in the area of the hip joint. (10)

Picture no. 12 - Graphical Illustration of the Gluteus Maximus muscle

Biomechanical Aspect of the muscle in relation to the hip joint area

The gluteus maximus muscle presents a status of increased development. The reason is it’s crucial role in the maintenance of the upright posture/stance. It is also important for several other functions of daily living such as: walking, climbing stairs, running e.t.c. During observation of the gait of another individual it is obvious that the gluteus maximus is dominating the pelvic area rather than providing contribution to the movement of the extension in the hip joint. Because the thigh is almost extended during the performance of the gait the main function of the gluteus maximus is concentrating on the trunk extension and the dorsal tilt of the pelvic region. Also during the performance of flexion of the trunk the gluteus maximus prevents from excessive forward movement. In case there is some weakness on the gluteus maximus that doesn’t prevent the extension or decrease the extension force as there is compensation by the hamstrings group of muscles that are powerful extensors of the thigh. (19)

Gluteus Medius m. (L. musculus Gluteus Medius**)**



Origin: Outer gluteal surface of the ilium bone, the particular muscle is located beneath the gluteus maximus.

Insertion: The greater trochanter of the femur bone

Function: Abduction and internal/medial rotation of L.E in the area of the hip joint (10)

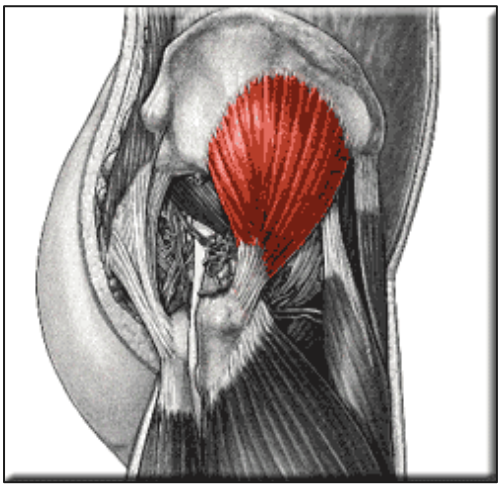
Picture no. 13 - Graphical Illustration of the Gluteus Medius muscle

Biomechanical Aspect of the muscle in relation to the hip joint area

The abduction of the lower extremity in the area of the hip joint is a very important movement when it comes to activities of daily living or of leisure time. During the performance of the gait the abductor group of muscles (as well the adductors) is mainly responsible for the stabilization of the pelvic region and of the thigh area. In case the gluteus medius (the main abductor of the L.E in the hip) wouldn't function during the walking the result would be the pelvis to fall during the non-stance limb. This is very important as a weak gluteus medius can lead to cases such as controlateral pelvis drop, increased femoral adduction and internal/medial rotation (19)

Those conditions have as a natural consequence some abnormal conditions such as: increased knee valgosity, excessive lateral tracking of the patella, increased tibial rotation and pronation of the foot. (19)

Gluteus Minimus m. (L. musculus Gluteus Minimus**)**



Origin: Outer/Gluteal surface of the ilium – located beneath the gluteus medius muscle

Insertion: Ridge of the greater trochanter of the femur bone.

Nerve: Superior gluteal nerve – nerve roots: $L_{4\rightarrow5}$, S_1

Function: Abduction and internal/medial rotation of the L.E in the area of the hip joint (10)

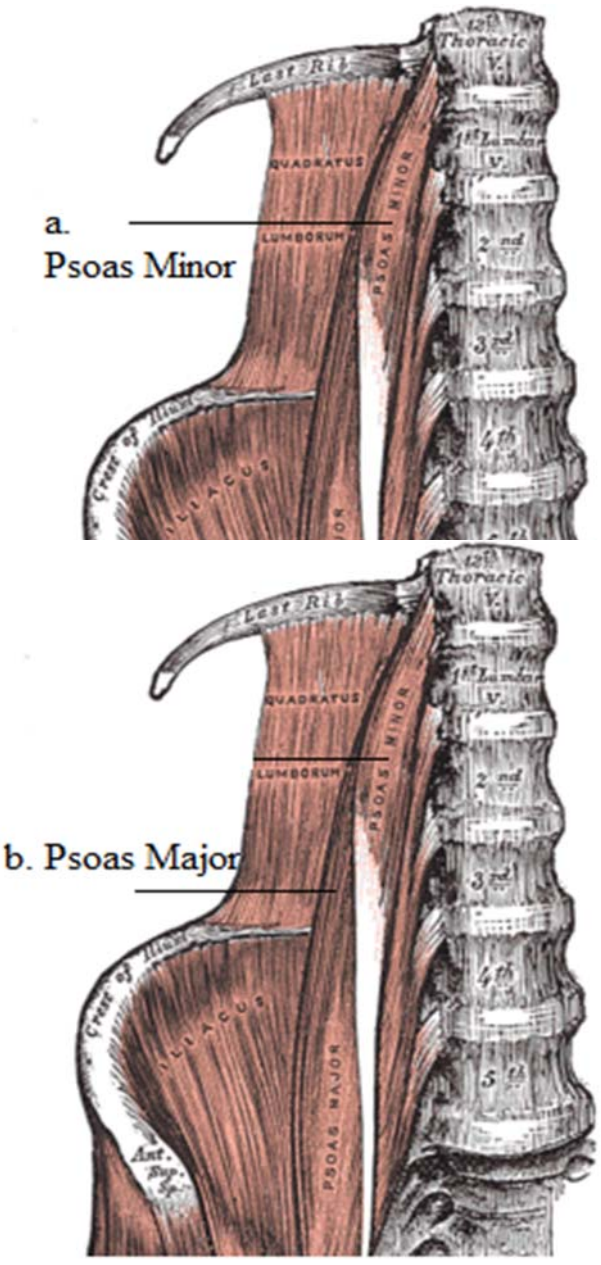
Picture no. 14 – Graphical Illustration of the Gluteus Minimus muscle

Hip flexors – Iliopsoas muscle

In many medical, anatomy-related documents the iliopsoas muscle is not considered as a single muscle but more as a composition of three different muscles. Those are:

- The Psoas Major muscle
- The Psoas Minor muscle and
- The Iliacus muscle

Psoas Major m. (L. musculus Psoas Major)



Origin: Transverse processes of T_{12}→L_5 /lateral aspect of the in-between discs

Insertion: Lesser trochanter of the femur bone

Nerve: Lumbar plexus

Function: Flexion and external/lateral rotation of the lower extremity in the area of the hip joint. (10)

Picture no. 15 - Graphical Illustration of the Psoas Major muscle – Edited

Psoas Minor m. (L. musculus Psoas Minor)

Origin: Lateral vertebral bodies of T_{12} and L_1 vertebrae and inter-vertebral discs

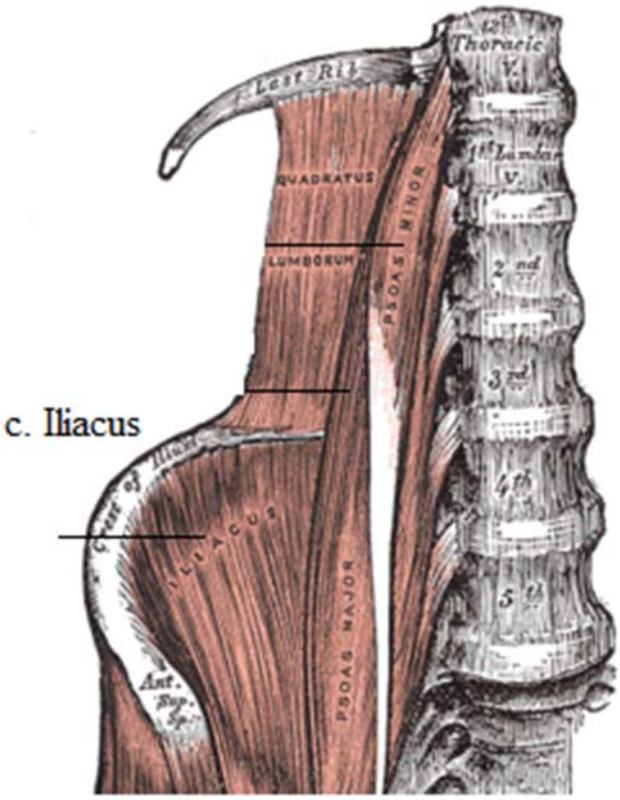
Insertion: Pectineal line and ilio-pectineal eminence.

Nerve: Anterior ramus of nerve L_1

Function: The psoas minor is characterized as a weak flexor of the hip joint (10)

Picture no. 16 - Graphical Illustration of the Psoas Minor muscle – Edited

Iliacus m. (L. musculus Iliacus**)**



Origin: Inner body of the iliac crest/ upper fossa of the ilium

Insertion: Lesser trochanter of the femur bone as well several sites of that particular bone.

Nerve: Femoral nerve

Function: Flexion and external/lateral rotation of the lower extremity in the area of the hip joint (10)

Picture no. 17 – Graphical Illustration of the Iliacus muscle – Edited

Biomechanical Aspect of the muscle in relation to the hip joint area

The iliopsoas muscle (**L**. Musculus Iliopsoas) is the strongest flexor of the hip joint. The muscle contributes also in the lumbar segment of the spinal cord not only on the hip joint. When the trunk is stabilized the iliopsoas muscle is producing flexion at the area

of the hip joint. That movement is slightly facilitated with the thigh been in a position that presents:

- Abduction and
- External/Lateral rotation

When the thigh is fixed, the iliopsoas muscle is producing hyper-extension of the lumbar vertebrae and flexion of the trunk. Whether the whole trunk of the patient is lifted or the lower extremities are lifted the iliopsoas muscle contributes the most in exercises that require the flexion of the hip joint. (19)

2.1.9 Nerves

The major nerves that can be found on the associated area of the hip joint – spreading along the hip are the followings:

- Femoral Nerve
- Sciatic Nerve

Femoral Nerve (L. Nervus Femoralis**)**

The Femoral nerve occupies the anterior part/area of the human body. It carries contributions from the anterior rami of L_2 to L_4 and leaves the abdominal area going through the gap between the inguinal ligament and superior margin of pelvis in order to enter the femoral triangle. (10)

The Femoral nerve is providing the innervations to:

- All the muscle groups that are located on the anterior compartment of the lower extremity
- Muscles of the abdominal area
- Skin on the anterior aspect of the thigh, antero-medial side of the knee, the medial side of the leg and of the small foot. (10)

Sciatic Nerve (L. Nervus Ischiadicus**)**

The sciatic nerve is the largest nerve of the human body. It carries contributions from L_4 to S_3. The sciatic nerve is located on the posterior compartment of the body. Specifically it leaves the pelvic region through the greater sciatic foramen inferior to the piriformis muscle, enters and passes through the gluteal region and then enters the posterior compartment of the thigh. In that part the sciatic nerve is dividing into the two main branches of it:

- The common fibular (**L**. Peroneal) nerve (**L**. Nervus Fibularis Communis) and
- The tibial nerve (**L**. Nervus Tibialis**) (**10**)**

The sciatic nerve is providing innervations to:

- Most of the muscles located on the posterior compartment of the thigh
- The adductor magnus originating from the area of the ischium
- All muscles of the lower part of the lower extremity and the area of the small foot
- The skin on the lateral aspect of the lower extremity and the plantar surface of the foot (10)

2.1.10 Arteries, Lymphatics and Veins

Arteries

The main artery that supplies the lower extremity and unexceptionally the hip joint is the femoral artery (**L.** Arteria Femoralis). The femoral artery is the continuation of the external iliac artery in the abdomen. The external iliac artery becomes the femoral artery as the vessel passes under the inguinal ligament to enter the femoral triangle. All that distinction takes place on the anterior aspect of the thigh. The femoral artery is responsible for the blood supply of the lower extremity and especially of the areas of the thigh, calf and small foot. It could be said that the femoral artery is an expansion of the big aorta, that largest artery of the human body starting from the heart. (10)

Femoral Triangle: the particular term that was mentioned above refers to the area of the human body that is formed by muscles in the upper thigh at the junction between the anterior abdominal wall and the lower extremity. (10)

Other vessels that are supplying the lower extremity with blood are the inferior and superior gluteal arteries and the Obturator artery. (10)

The superior and the inferior iliac artery have their origin at the pelvic cavity and more specifically they are the expansion of the internal iliac artery. Seeing the pelvic region from the frontal point of view you can see the superior gluteal artery leaving the pelvic cavity to the lateral side and passes through the greater sciatic foramen. The inferior gluteal artery passes also from the same foramen. The difference between them is that the superior takes a circuit above the piriformis muscle while the inferior follows a circuit right beneath the same muscle. (10)

The obturator artery is also an expansion of the internal iliac artery that enters the pelvic cavity. The main function of the obturator artery is the supply of the medial compartment of the thigh area. (10)

Veins

Concerning the venous system of the lower extremities, there is a distinction into a superficial and deep group of veins. The deep veins in general are following the arteries (femoral, superior & inferior gluteal artery, obturator artery). The major deep vein in the area of the lower extremity is the femoral vein. The circuit of the femoral vein begins from the height of the lumbar segment of $L_4 \rightarrow L_5$ where the inferior vena cava is splitting into two branches the left and right common iliac vein. At the point of inguinal ligament the femoral vein "begins". The superficial veins for two major channels: the great saphenous vein and the small saphenous veins. (10)

Lymphatics

Superficial inguinal nodes

The number of the superficial is attributed approximately around ten. They are located on the superficial fasciae and in a parallel course with the inguinal ligament in the upper compartment of the thigh. The superficial inguinal nodes are receiving lymph from the gluteal region, the lower abdominal wall, the perineum and superficial regions of the lower extremity. (10)

Deep inguinal nodes

The number of the deep inguinal nodes is counted up to three. They are located medially to the femoral vein. The main function of the deep inguinal nodes is to receive lymph from parts of the body such as the deep lymphatics associated with the femoral vessels and from the glans penis (or clitoris) in the perineum. The deep inguinal nodes are inter-connecting with the superficial ones and drain into the external iliac nodes. (10)

Popliteal nodes

There is a collection of deep nodes. Those nodes are located on the posterior aspect of the knee joint close to the popliteal vessels. Those particular nodes are supplied with lymph from both superficial vessels and deep ones – located in deep areas of the calf and foot area of the lower extremity. (10)

2.2 Osteoarthritis (O.A.)

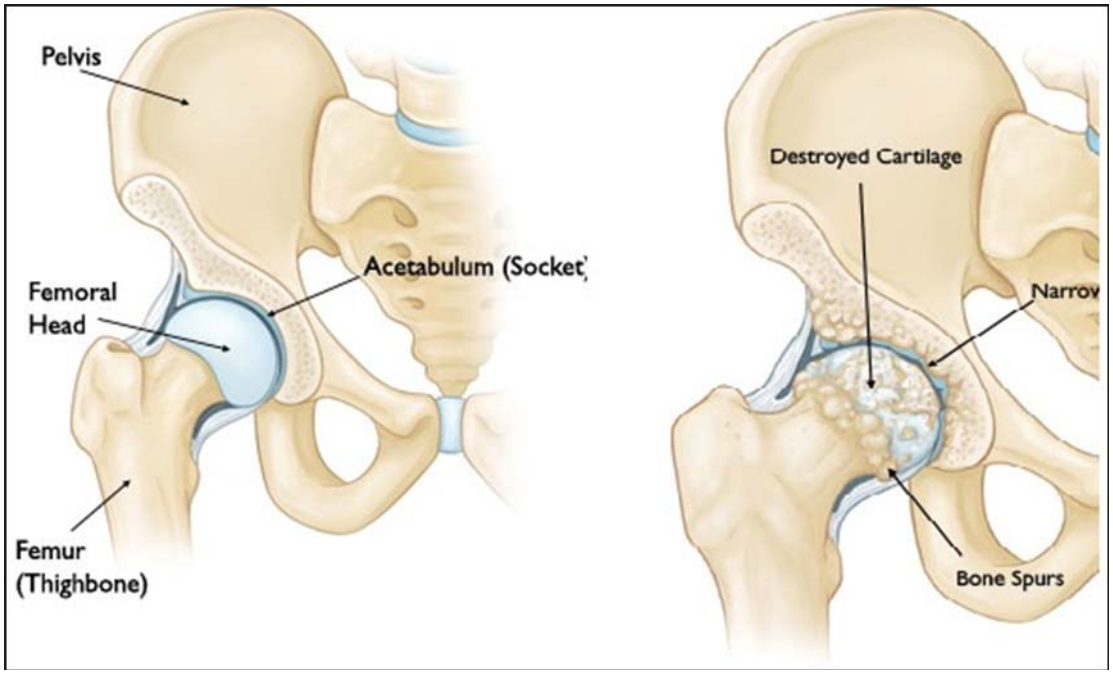
2.2.1 Definition

Osteoarthritis – found also under the name degenerative joint disease is the most common pathological condition concerning the area of the hip joint. As described before the hip joint is the result of the articulation of the spherical head of the femur

bone and the acetabulum of the pelvic bone. The anatomical arrangement of the hip joint permits the performance of a lot of movements in several planes. Great amount of mechanical force (equal to three to eight times the body weight) are exerted on the hip joint during the performance of basic activities of daily living such as walking, standing, running, climbing stairs e.t.c. (14)

Synonyms	Ic-9 codes
Hip osteoarthritis	**715.15** Primary (idiopathic) osteoarthritis of the hip joint
Hip degenerative disorder	**715.25** Secondary osteoarthritis of the hip joint
Degenerative hip joint	**716.15** Traumatic osteoarthritis of the hip joint
Coxarthrosis (primary)	

Table no. 01 - Synonyms and Ic-9 codes of the osteoarthritis of the hip joint



Picture no. 18 – Graphical Illustration of a normal hip joint (left figure) and a hip joint that presents arthritis (right figure)

2.2.2 Etiology

The most common etiology that everyone is coming up with is the aging of the individual since primary type of osteoarthritis occurs mainly in middle-aged and elderly. But that doesn't mean that the osteoarthritis is simply an expression of the senescence and the impact that has the aging on the associated joints of the human body. As also individuals that are characterized as over-weight or over-worked can express osteoarthritis in their joints. Generally the problem is located on the cartilage of the joints. It is a fact that the cartilage in the joints is aging, presenting signs of diminished cellularity, reduced proteoglycean concentration, and decrease in elasticity and breaking strength through the years.

From a theoretical point of view the primary changes that occur concerning the matrix of the cartilage might weaken the until-then solid structure and eventually lead to the breaking-down. Well-known examples of such cases are the crystal deposition disease and ochronosis.

Another factor that has been considered important for many years is the inheritance. Studies have shown a general increase in the prevalence of the generalized osteoarthritis in individuals that are first-degree relatives with patients suffering from osteoarthritis. However it is also important to have in mind that in many cases the occurrence of osteoarthritis in large joints, is the result of anatomical variations e.g. dysplasia in the area of the hip joint, and it is this that are inherited through generation rather than any tendency to develop osteoarthritis as a primary abnormality. (31)

2.2.3 Symptoms / Clinical Picture

Following is a list of symptoms that someone can identify in patients that present osteoarthritis of a joint (in that case of thesis in the area of the hip joint)

- **Pain**: Pain is the landmark of the particular disorder. There are cases that the patient that has as a point of origin the hip may spread to other near-like structures (on the lower extremity). For example the pain that starts from the hip joint may radiate down to the knee joint. The pain that the patient feels during the first stages of the manifestation of O.A. can be characterized as a "silent pain". The reason is because it manifestoes itself very insidiously and as the time comes it increases in intensity. The pain is presenting aggravation when the individual is performing several activities and decreases when he/she rests. In a most severe stage of the disorder, the pain may interrupt with the sleeping of the patient – not letting him/her relax in order to sleep or interfere with the sleep during the night hours. There are many possible causes related to the pain: synovial inflammation, capsular fibrosis, muscular fatigue e.t.c.(14)

- **Stiffness:** The stiffness is also another common sign of the disorder. Specifically the stiffness occurs after periods of inactivity of the individual. As the times goes the stiffness will progress and will lead to limited range of movement concerning the extremities of the individual (31)

- **Limited movement:** As also described in previous section the limited range of motion is a general symptom of O.A. In most of the cases it can be characterized as a landmark of the particular disorder. The most of the movements that are performed by the lower extremities in the area of the hip joint are restricted and are accompanied with pain when they are performed in extreme range. (31)

- **Instability:** Instability is usually seen as a late stage in the cases of articular destruction. The only way to detect much earlier is by performing special testing. The reason that may lead to the occurrence of instability is the loss of cartilage and bone, the asymmetrical capsular contracture and the possible weakness of the associated muscle groups. (31)

- **Swelling:** The state of the swelling can be characterized either intermittent or continuous. The swelling on the joints is the first thing that someone notices, especially if it concerns the peripheral type of joints. The reason is the general picture of those joints as they present effusion, hard ridges around the margins of the distal interphalangeal or metatarsophalangeal joints for example (31)

- **Deformity:** The deformity might be the result of capsular contracture or joint instability, but it can also contribute into the occurrence of O.A. The deformity of a joint is a very easy to spot symptom for example in the case of the knee joint or the large-toe metatarsophalangeal joints. On the other hand in the case of the hip joint some possible deformity is masked by postural adjustment of the pelvis and the spine. (31)

- **Loss of function:** It can be characterized as the most distressing symptom. The loss of function is associated with the inability of performance several important functions for the individual such as: climbing stairs, walking distances, inability to perform some leisure activities (31)

- **Daily Living Activities:** The activities of daily living are of great importance and in some cases when they especially concern leisure time are very important also for the psychical health of the individual. The ability of the performance of the daily living activities should be accessed. In some cases the performance of X-ray screening is not evaluating the real condition of the patient as it doesn't express the pain that the patient is feeling or the degree of the actual functional capacity. In those cases a more practical examination should be performed such as:
  - If the patient is able to walk up and down the stairs
  - Rise easily or not from the chair
  - Does he/she limps during the performance of the gait or there is adoption of an analgesic type of gait
  - Is the patient using walking support (e.g. walking crutches) (14)

Signs of Osteoarthritis
Narrowing of the "joint space"
Sunchondrial sclerosis
Marginal osteophytes

Subchondial cysts
Bone remodeling

Table no. 02 - Signs of Osteoarthritis

2.2.4 Physical Examination

Following is a list of examinations that can be performed in order the therapist will get a more overall picture of the condition of the patient with O.A.

Evaluation of the gait stereotype
Usually the patient that presents O.A. will adopt an analgesic type of gait. During that, the period of standing on the associated lower extremity (the one of the O.A. hip) will be significantly decreased, while the double stance support will be longer than normally.
(14 & 24)

Palpation
The palpation that the examiner is performing is important into the evaluation of the tonicity of the muscles. Apart from that the sites that might be presenting pain expect the area of the hip and need to be palpated are: great trochanteric bursae, iliotibial band, sacroiliac joints and ischial bursae. (14)

Evaluation of range of motion (R.O.M)
The examination/evaluation of the range of motion is a very important part of the general assessment of the patient. At the early stage of O.A. there is a restriction of the internal rotation of the lower extremity in the hip joint. Generally there will be restriction to most of the movements of the lower extremity concerning the area of the hip joint (14 & 22)

Additional Note
Limping, pain located on the area of the groin and restricted IR indicates a hip disorder than a spine-one. (14)

Patrick Sign/Test
The Patrick sign/test is performed having the patient in supine-lying position on the examination bed. The upper extremities of the patient should be relaxed on the examination bed and the area of the low back in contact with the bed. As for the lower extremities the associated lower extremity is flexed in the area of the hip and knee joint, touching with it's heel the medial/internal aspect of the knee joint forming a "four shape". The particular position can be also found under the naming "FABER maneuver".
The hip joint presents:

- Flexion
- Abduction and
- External Rotation

The examiner has to push the raised lower extremity towards the examination bed. The production/presence of pain in the area of the groin indicated intra-articular hip disorder. In case the pain is felt in the area of the back then the major problem will probably be sacro-iliac joint disease. (14)

2.2.5 Differential Diagnosis

The causes of the occurrence of arthritis in the area of the hip joint can be divided according to the area where the arthritis is found. (14)

Intra-articular	Extra-articular
Avascular Necrosis (A.N)	Fracture of the femur bone
Infection of the hip joint	Trochanteric bursitis
Acetabular fracture	Iliotibial band tendinitis
Rheumatoid arthritis (R.A)	Snapping hip syndrome
Hip labral (cartilage) tear	Muscle or tendon groin strain
Protraction of the acetabulum	Sacroiliac pain
	Coccydynia
	Lumbosacral radiculopathy

Table no. 03 - Table of the differential diagnosis for arthritis of the hip joint

2.2.6 Prevention of the occurrence of osteoarthritis of the hip joint

The medical knowledge and the kind of technology that the man possesses nowadays make the dealing of such cases like osteoarthritis of hip an easy case with the associated surgical procedure being a routine matter. But that doesn't mean that the contemporary individual shouldn't take in consideration several methods in order to prevent the occurrence of such conditions. Following are six of such simple methods that could be followed by everyone without exception:

- **Maintain the ideal body weight**
  Researchers have shown that during the performance of gait, the force that is exerted to the bones equals three to six times the weight of the individual. Of course that means that the bones of the human body fetching a lot of weight/pressure. In the case of the hip joint, the force that is exerted across the joint is three times the body weight. In summary losing weight or maintaining the ideal one reduces the pressure exerted on the bones (8)

- **Physical Activity – Exercise regularly**
  The best program of physical activity includes five days of exercise during the week, with each day consisting of thirty minutes of alternative intensity exercise. The physical activity has beneficial results on the general condition of the patient (8)

- **Protection of the joints**
  The different ways of protecting the joints have as aim the conservation of energy and the preservation of the function of the joints. Good posture and proper body biomechanics are important factors that need to be followed in order to protect the joints. (8)

- **Avoid stressing the joints**
  That should be taken in serious consideration especially if concerns a physical activity that is performed repetitively. (8)

- **Pain**
  The particular recommendation seems so easy and easy-predictable but there are cases that even though pain is felled they ignore that feeling. The individual should learn to interpret the pain as a signal. That particular signal might indicate to the individual that he/she is over-doing some of the physical activities. For keeping the joints in a healthy condition important is the balance between the exercise and rest. The individual should know his/her limits and not push him/herself to the limits. The pain should be a "stop-sign". (8)

- **Avoidance of injuries during performance of sport activities**
  Previous joint injuries are a main factor for occurrence of osteoarthritis in the continuity of life. The joints that have been injured in the past present some weariness concerning the articular cartilage and are more vulnerable to the occurrence of osteoarthritis. (8)

2.2.7 Treatment

We can divide the general treatment that is followed in such cases into the initial treatment and the rehabilitation.

Initial treatment

During the stage of the initial treatment, the main concern is the providence of information to the patient concerning the disorder of his/hers. The therapist/associated doctor is discussing with the patient the different aspects of the diagnosis, the prognosis and the possible ways of treatment. The patients are encouraged to take an active role into the whole procedure – therapy program in order to maximize the outcome. (14)

Physical Therapy

Physical Therapy is applied in many cases of osteoarthritis of the joints. The main aim of performance of physical therapy procedures is to strengthen the muscles that surround the joint. While the muscle are getting stronger are more able to sustain big pressure (coming e.g. from the weight of the body of the individual) and in that way the joints are not burden. (14)

Weight Loss

The weight loss is a very important factor in the therapy program. According to researches the connection of the over-weight status with the osteoarthritis especially when it concerns the hip joint is not clearly established. Nonetheless the loosing of weight is an important factor in the general physical health/fitness of the patient and in addition it isn't a factor that is burdening the associated joints. When it comes to the hip joint the forces that are acting are three to five times the body weight (14)

2.3 Fractures

Etymology: **L**. frangere = *to break*
The fracture is defined as a traumatic injury of the bone, during which there is observed the interruption of the continuity of the skeletal tissue. The further classification of the fracture depends on several factors such as the type of the bone that is involved, the part of the bone, or the nature of the break e.t.c. (29 & 31)

2.3.1Mechanism of injury (fracture)

The main reason for the occurrence of the fracture in the area of the femoral neck is the incidence of falling. However in the case of patients that suffer from osteoporosis the falling is not the main reason for the occurrence of fracture. In that case movements like for example a twisting movement of the lower extremity in the area of the hip joint towards external rotation might be enough to result into a fracture. In younger individuals that doesn't present some kind of osteoporosis or any other degenerative disorder affecting the bones of the body, the fractures are the result of basically falling from height or any kind of blow. Those patients are presenting numerous fractures and in a rate of 20 per cent those patients present also fracture on the body (**L**. *shaft*) of femur. Stress fracture includes all those that are performing activities that place an extra load on the bones. (31)

In summary the fractures are occurring from:

1. Injury
2. Repetitive stress that is applied on the associated bone
3. Abnormal weakening of the bone – in that case we are talking about "pathological fracture" (31)

2.4 Fracture located on the neck area of Femur bone

The area of the neck of the Femur bone is the commonest site for the occurrence of a fracture. Most of the cases of femoral neck fracture attribute an individual, usually female one that is going through her seventh or eighth decade. In most of the times basic disposition for the occurrence of such fracture is the degenerative disorder of osteoporosis. The connection of the occurrence of the femoral neck fractures with the degenerative disorder of osteoporosis is such decisive that in many population studies the femoral neck fractures are used for defining the age-related osteoporosis. Other risk factors that can play an important role for the occurrence of such an injury are: alcohol,

bone-losing or bone weakening disorders, diabetes, stroke or some other kind of chronic deliberating disease. But a very large group of people that is very vulnerable are the elderly. Apart from the reasons that were described above the disturbance of the balance and the increasing numbers of falling increase the chances for the occurrence of fractures on the neck of the femoral bone. (31)

2.4.1 Present Perspectives

According to studies the incidents of femoral neck fractures are approximately going to double the next 30 years. The reason behind this statement is the several factors such the medicaments, medical experience and improvement of the technology used in the field of medicine enabling the individuals to extend their life beyond the age limit of 65 years. (31)

2.4.2 Clinical Diagnosis

Generally there are reported four situations during which fracture located on the neck of the femur bone has been non-diagnosed by the associated medical stuff. Sometimes the inability to diagnose the presence of a fracture on the area of the femoral neck might have dire consequences for the particular patient:

1. **Stress fractures**
   In the case of elderly people that are experiencing an un-explained pain localized in the area of the hip joint, the suspicion of the associated doctor/ medical stuff should include firstly the possibility of a stress fracture before any further evaluation is performed. The same principles should be followed when the patient is a young child who is performing any kind of impact-loading sport in regular basis, or a adult in similar activities e.g. military personnel, construction-worker. The first method for evaluation such condition should be the performance of x-ray. But the performance of Magnetic Resonance Imaging (M.R.I) is usually the best way of evaluating any possible lesion in the associated area. (31)

2. **Undisplaced fractures**
   The following fracture is very difficult to be evaluated through the performance of x-ray. On the other hand the bone scan or M.R.I will produce more relevant trust-worthy results but after a few days. (31)

3. **Painless fractures**
   A bed-ridden patient may present a “silent” fracture. In the case of a patient that is characterized of good physical state, may walk or perform any other kind of daily living activities while there is an impacted fracture. During those performances there is no pain. If the context suggests surgery the examiner should evaluate when the patient is complaining about the pain. (31)

4. **Multiple fractures**
   In the case of multiple fractures there is the possibility that some of them may pass unnoticed. For example a patient that presents a fracture located on the

body (**L**. shaft) of the femur bone may also have a fractured hip bone. The particular fracture can be very easily missed unless the associated doctor has the suspicion of investigating also the area of the pelvic bone through the performance of X-ray. (31)

2.4.3 Complications

When it comes to the possible complications after the occurrence of fractures, we recognize the following subcategories:

- General complications: the general complications concern patients of all ages and include pathological conditions such as deep venous thrombosis, pneumonia or pulmonary embolism. (31)
- Avascular Necrosis (A.N): A pathological condition that is characterized by the disruption of the blood passing during the occurrence of the fracture (31)
- Non-union: More than thirty per cent of the fractures that concern the area of the neck of the femoral bone fail to re-unite. (31)

2.5 Addressing the disorder

2.5.1 Types of treatment applied

The treatment of the patient can be divided into two big subcategories:

- The conservative way of treatment and
- The non-conservative one

Both of them are using different ways and approaches to the chief complaint of the patient.

2.5.2 Conservative Treatment

The term conservative treatment refers to the treatment of a medical condition (pre-operative or post-operative) without the application of surgical utilities

Methods under the conservative treatment

- **Usage of heat and cold procedures:** The particular procedures lead to the relief of the irritated joints of the patient's body. If the patient isn't correlating the discomfort that is felt with the performance of s particular activity then most heat can be applied. The moist heat has more effective results compared to the dry one and is promoting increase of the blood circulation and releases the muscle spasms. The patients that suffer from osteoarthritis may happen to have different preferences concerning the amount of heat or cold so experimentation with the application of the procedure is wanted. (24)

- **Medication:** A number of medications are available nowadays for the dealing of the osteoarthritis. There are some cases reported that the particular medications

had some side-effects affecting for example the stomach of the patient, but the newer produced drugs seem to have more results and less side effects generated (24)

- **Maintenance of the range of motion:** That statement/goal is relevant as there can be cases where the aim is not the maintenance of the available/current range of motion but the improvement of it. In either case it is a common fact that after the surgical operation of total hip replacement the range of motion of the lower extremities presents some restriction. Exercises that assist into the stretching and strengthening the muscles are important as they improve the range of motion and decrease the stiffness that the patient feels. (24)

- **Strengthening exercises:** As it was briefly mentioned before the performance of the strengthening exercises for the muscles of the lower extremities is benefiting the stability of the joints. A strong muscle will support the joint in a better way and more effectively than a muscle that is less strong. In the case of sportive patients there might be the need for the modification of some of the exercises that they are performing. Even though at the beginning the change of the exercise will have a practical and psychological difficulty at the end the patient will be surprised with the outcome of the exercise. (24)

2.5.3 Non-conservative treatment

The term non-conservative treatment is used in order to describe all the procedures concerning the performance of a surgical operation for the dealing of a disorder.

2.5.4 Total Hip Replacement surgical procedure – Introduction

Total hip replacement is a surgical procedure that is performed in order to correct the damaged/injured hip joint of the patient. During the performance of the total hip replacement the head of the femur bone and the acetabulum of the pelvic bone are replaced by artificial components the material of which varies (29)

Firstly performed in 1960, hip replacement is one of the most successful surgical operations in the field of medicine. Since 1960 the improvement of the surgical components that are used and of the technology has contributed into the increase of the effectiveness of the associated surgical operation. (3)

When a patient undergoes the surgical operation of the total hip replacement what actually happens is that the medical team, responsible for the performance of the operation, is replacing at it's entirety the articular surface of the associated joint – bones that are forming the joint. (3)

Synonyms	Ic-9 Codes
Total hip replacement	**715.95** Osteoarthritis hip
Unipolar hemi-arthroplasty	**733.42** Aseptic necrosis of bone, head and neck of femur

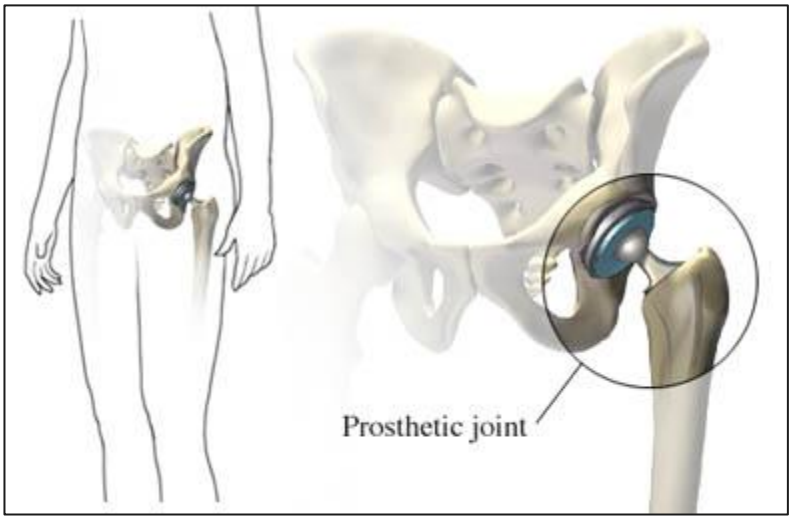
Bipolar hemiarthroplasty	**820.09** Fracture of the neck of femur, other (head of femur – sub-capital)
Revision arthroplasty	**835.00** Dislocation of hip
Birmingham hip resurfacing	**996.59** Loosening of total hip replacement
	V43.64 Total hip replacement

Table no. 04 - Synonyms and Ic-9 codes under which the total hip replacement can be found on medical documentations.

2.5.5 Description of the procedure

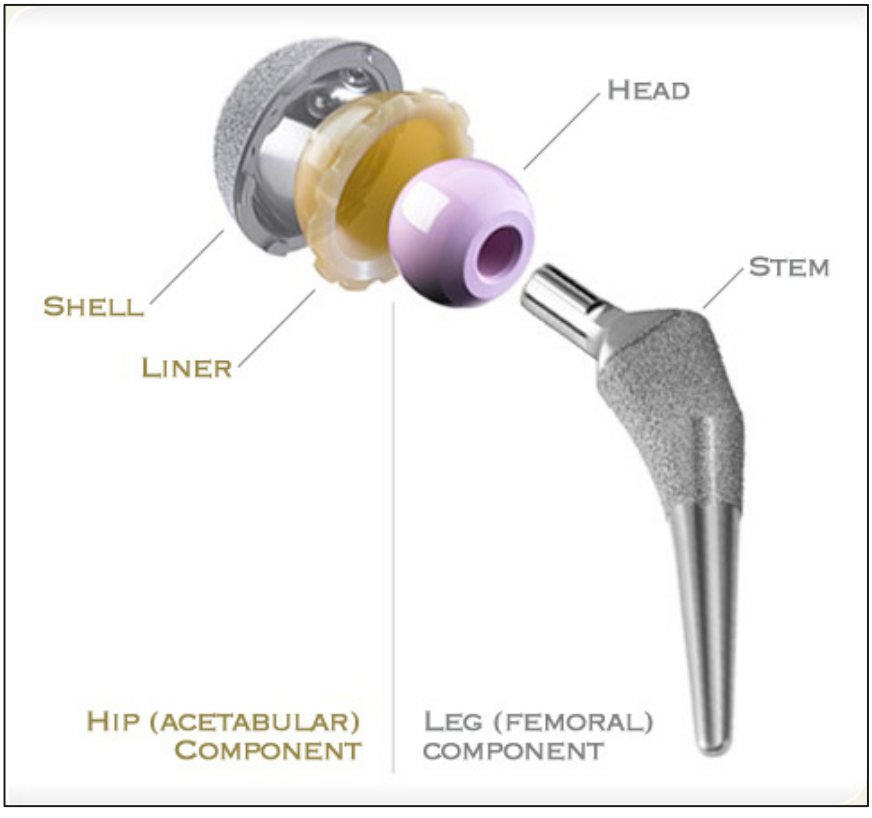
The main concern during the total hip replacement (also found under the name hip arthroplasty) is the replacement of the damaged components of the hip joint by artificial ones. The steps of that procedure are:

- The damaged head of the femur bone is removed. In it's place the medical team that performs the surgery is placing a metallic stem. That particular stem is placed in that way that is plunging most of the hollow center of the proximal part of the femur bone. The metal implant/stem should be cemented or "press fit" into the bone of femur.
- Then a metal or ceramic ball is placed on the upper part of the stem, forming the new head of femur bone. The damaged head is removed.
- The next step of the procedure concerns the replacement of the area of the acetabulum of the pelvic region. The damaged cartilage surface of the associated area is removed and is replaced by metal component. In some cases in order to add stability in the whole new structures the surgeons might add screws or cement.
- The last step/concern is to ensure that the gliding between the two newly applied components will be smoothly performed. For that reason a spacer made out of plastic, metal or ceramic material is placed in the associated area.(31)
- Currently on the market there are nearly three hundred different mechanisms concerning the implants that are used in the operation of the total hip replacement. That statement ensures the patient for the outcome of the surgical operation. After the end of the surgical operation, while the patient is on the post-operative time of recovery, full loading on the implant should be avoided.
- The patient spending six weeks on the crutches is not unreasonable. (31)



Picture no. 20 - Graphical Illustration of the prosthetic hip joint

Picture no. 21 – The different components that are used in a procedure of total hip replacement



Picture no. 22 - The acetabular component of the total hip replacement

2.5.6 Indications

One major disadvantage of the total hip replacement is that the implants are loosening over the years. That's why the performance of the surgical operation of the total hip replacement was reserved for patients over 60 years old. However due to the huge development of medicine nowadays and of course of the way of development of the medical devices, the surgical operation can be performed with:

- Elderly people
- Younger patients with destructive disorders of the hip joint and
- Cases of rheumatoid arthritis in children (31)

2.5.7 Implant Options

As already described above the procedure of the surgical operation of the total hip replacement is based on the re-construction of the damaged hip joint. The re-construction is succeeded through the use of artificial materials. The types of the materials that are going to be used depend on several factors such as:

- The age of the patient
- The level of activities of the patient
- The preference and specialization of the associated surgeon that will perform the replacement. (8)

In conclusion the possible options of materials that can be used for the total hip replacement are:

1. Metal and Plastic materials
2. Metal on metal
3. Ceramic on ceramic and
4. Metal and highly cross-linked polyethylene. (8)

2.5.7.1 Metal-and-Plastic materials/implants

The use of metal and plastic materials is the most common cases when it comes to the case of surgical operation of total hip replacement. In that case metal material is used in order to re-construct the damaged head of the femur bone and the socket of the pelvic bone, but a plastic spacer is placed between those two implants in order to ensure the performance of gliding movements. Concerning the implant on the femur bone it can be cemented or press-fit:

- Cemented: When the implant is cemented that means that a special bone cement is implanted so that the freshly re-constructed hip joint will have stability in the performance of the several movements

- Press-fit: In the press-fit method the implant is fit snuggly inside the bone, and a new bone is formed around the implant to secure it's position. (8)

2.5.7.2 Metal-on-Metal materials/implant

The difference between the application of metal-on-metal implants and the metal and plastic implants is that there is no plastic spaced placed between the two materials providing the re-constructed hip joint with the possibility of performance of gliding movement. One advantage of the use of only metal materials is that they provide low wear-out rate. Despite that fact it is not yet known if they provide a greater period of endurance than the other methods of implantation. Despite that there are a lot concerns around the use of metal-on-metal implants:

- **Metal ions**: Metal ions are atoms that have either gained or lost an electron. When the total hip replacement is performed with the use of metal-on-metal materials is a commonplace to find those metal ions in the blood circulation and in that way "travelling" throughout the whole body of the patient. As times goes the concentration of those ions increases. The associated doctors are afraid of the possibility that the increased numbers of metal ions are related to the increased rates of cancer or other diseases. Until now there is no study or other valid statement to confirm something like that. (8)

- **Wear debris**: Except the presence of the metal ions there are concerns about the case of wear debris due to the nature of the material of the implants.(8)

2.5.7.3 Ceramic-on-Ceramic implants

The ceramic-on-ceramic implants are designed in that way in order to sustain the several ravages of time. Until now among the rest of the implants that are used in the total hip replacement are the ones that present bigger resistance. The ceramic implants are wearing lesser than the metal-on-metal ones and they are more scratch resistant and smooth moveable. But on the downside they present also some appreciable disadvantages:

- There is no data ensuring that the implants are available of long-term use and
- There is possibility that the ceramic implants could break leading to more severe problems during the post-surgical state of rehabilitation. (8)

2.5.7.4 Metal and high-linked polyethylene

The particular implants provide a bigger resistance against wearing out during the performance of the several movements of the associated joint. The particular implants are mainly designed for that reason (*not wearing-out*) and have been available as an

option for the total hip replacement surgical procedures the last few years. That means that there is not a lot of knowledge concerning the exact advantages and disadvantages of those implants. (8)

2.5.8 Complications of total hip replacement

The majority of the patients that undergone the performance of the surgical procedure of total hip replacement are mostly elderly people. The most common complication that is recorded is deep vein thrombosis (DVT). In the case of the total hip replacement the complication of deep vein thrombosis is more common than any other elective operation. (31)

Intra-operative complications

Includes perforation or even the occurrence of fracture of the femur bone or in the acetabulum. Special post-surgical treatment should be performed in the patients that are elderly, suffer from osteoporosis or have undergone in the past another surgical operation concerning the area of the hip joint. (31)

Sciatic nerve paresis-palsy

The sciatic nerve can be damaged by traction or by direct injury of the nerve. In both cases and most of the time the recovery is spontaneous but if there are suspicions of damage an examination should be performed on the associated area. The damage of the sciatic nerve can happen with any type of arthroplasty but is more common with any kind of surgical operation that is performed on the posterior compartment of the human body. This statement is very logical if someone considers the root of the nerve. (31)

Post-operative dislocation

The post-operative dislocation can happen only in case that the setting of the prosthetic components isn't performed correctly. The stabilization of the hip is easily performed through the traction of the lower extremity while is placed in a position of abduction. If the case is severe then revision might be needed, or augmentation of the socket (31)

Heterotopic bone formation

That case is seen in about 20% of the patients that undergone the surgical operation of the total hip replacement. More specifically that occurs after the five years of the post-operative time skip. The exact cause of the particular case is unknown. The patients that suffer from skeletal hyperostosis and ankylosing spondylitis are in high risk of presenting the Heterotopic bone formation. (31)

Aseptic loosening

The aseptic loosening occurs in the segments of the femur bone: acetabular socket or femoral stem. Both causes are leading to long-term failure. The rates of the incidence of

the aseptic loosening vary widely, depending on the criteria/methods that have been used in the surgical operation. According to the level of the modern methods that are used during those surgical operations the respectful number of such incidents (of aseptic loosening) is limited to 10% of the patients in a period of 15 years after the operation of total hip replacement. (31)

Aggressive Osteolysis

The aggressive osteolysis can happen accompany with or without the loosening of implant. It is associated with the formation of granuloma at the interface between the cement (implant) and the bone. (31)

Infection

The infection is characterized as the most serious post-operative complication among others. Following the associated rules of hygiene the risk rate for each surgical operation should be decreased approximately into 1%. The vulnerable groups that can present infection in the particular area are:

- Elderly people
- Patients that suffer from rheumatoid arthritis (*R.A*) or psoriasis
- Patients that undergone immune-suppressive therapy – for example therapy including corticosteroids.

The reason for the occurrence of infection is that the large bulk of foreign material that is introduced to the body is preventing/restricting the body's defense mechanism. Thus even a small wound can become a major problem for the patient. Even in later years after the surgical operation the patient can be troubled with late infection. The instant treatment that can be applied in the case of early infection is medial-one. (31)

2.5.9 Factors that lead to the occurrence of complications

The factors that are decisive concerning the occurrence of complications after the undergone o the surgical operation of total hip replacement are:

- Performance of previous surgical operation on the area of the hip joint
- Severe deformity
- Lack of pre-operative planning on the whole surgical procedure
- Inadequate "bone stock"
- The operative environment doesn't follow the principles of sterilization
- Lack of experience is met on the responsible team or doctor of the surgical operation (31)

2.5.10 Functional precautions during the post-surgical state

The following precautions/indications should be given to the patient by the responsible doctor/orthopedic after the end of the surgical operation. The instructions are

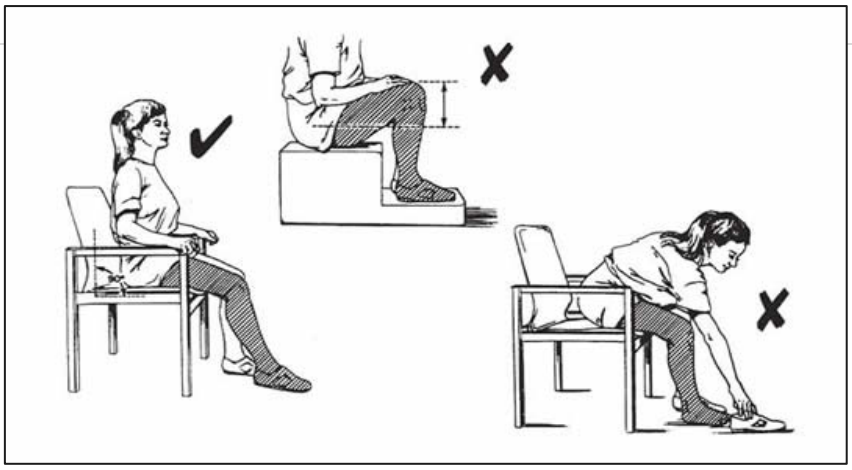
- **Avoid the flexion of the operated lower extremity at the area of the hip joint over 90^0**

  That statement renders the performance of some examinations e.g. the evaluation of the length of the hip flexors of the non-operated lower according to the principles of H.O. Kendall. During the performance of the evaluation the patient is called to flex the non-tested lower extremity and keep it close to the abdominal muscle area- so it will definitely exceed the 90^0 of flexion in the area of the hip joint. The avoidance of the flexion over the 90^0 of range of motion concerns the patients that are six or eight weeks after the undergone of the surgical operation of the hip replacement. The patient shouldn't be sitting in sofas or couches where the surface that he/she is sitting can't prevent the flexion over 90^0. Also when in sitting position on a hard pad like the one of the examination bed that is used for kinesiology examination a cushion should be used under the area of the buttocks of the patient. (9)

Picture no. 23 – Graphical Illustration of the prohibited flexion over 90^0 in hip

- **The patient should avoid crossing the lower extremities**

  That statement is stricter when it comes to the crossing of the operated lower extremity over the non-operated one. For that reason during the hospitalization of the patient post-surgically, a cushion should be placed between the two lower extremities of the patient. The approximate distance that should be maintained is about 3 to 6 inches apart. Also when the patient wants to rotate on the examination bed or the therapist performs that, the cushion between the two lower extremities should remain in that position of the femur bone. (9)



Picture no. 24 - Graphical Illustration of the precautions of the post-surgical state of total hip replacement during some activities of A.D.L.

What's the problem with those positions/movements?

No matter the material that is used in the total hip replacement, the implant is not stable as is the physiological hip joint. If the patient performs one of the above mentioned forbidden movements it will eventually lead to the occurrence of dislocation of the freshly operated hip joint. In case there is dislocation of the hip then the hip implant should be put back in place that will take place in the emergency room by the associated medical staff. There are cases that after the dislocation of the operated hip there should be done one second operation of the same nature on the associated area. One important consideration is that the hip dislocations can damage the implant that is used. (9)

2.5.11 Thigh pain after hip replacement

In some cases patients after the performance of the surgical operation of total hip replacement are experiencing some kind of pain located on the area of the thigh. Patients who experience that condition shouldn't be worry about it as it is very common after the performance of such procedure. That doesn't mean that the severity or the character of pain is the same among the post-surgical patients. There are plenty of causes that could lead to the occurrence of such pain in the area of the thigh:

- Over-loading of the operated/associated lower extremity (usually that kind of pain is subsiding after a small period of time)
- Some kind of infection caused by the surgical operation – the danger in such cases is that the infection may spread to neighboring body segments
- Unsuccessfully carrying out of the total hip replacement procedure leading the joint to start loosing up more and more after a few days.

Except from that the normal process of the total hip replacement is accompanied with the affection of many body parts in the area around the site of the incision e.g. many tissues, muscles e.t.c.

The dealing of such cases is long-term but it has to be done in order to avoid further complications that can be more severe. In case that the character of pain is chronic then the patient should inform his/her doctor and perform a screening test that would include for example the performance of X-rays in order to evaluate the true nature of the problem. (38)

3. Special Part (Case Study)

3.1 Methodology

The clinical practice for my Bachelor Thesis was done in the Central Military Hospital, located in Ústřední Vojenská Nemocnice in Prague (Praha 1200/1, 162 00 Praha 6). My clinical practice lasted two weeks, expanding from the 16th of January 2012 till the 27th of January 2012. The daily hours of practice were 8 hours and in summary I performed 80 hours of practice.

My clinical practice was supervised by Mgr. Zuzana Sekaninova of the department of physical rehabilitation.

During the period of time that my practice took place, I consulted my patient six times. The first one took place the Monday 16th of January 2012 which was also the first day of working in the associated department of the military hospital. The patient was visiting the department day by day resulting to three consultations per week. The last consultation with the patient took place the Friday 27th of January which was also the last day of my practice in the military hospital.

During the performance of the therapeutic units our main concern for the patient was the improvement of the balance of hers. For that reason mainly manual therapy was applied but as well I used specially designed equipment for the improvement of the sensory perception and the balance and co-ordination of the patient.

During the performance of the examinations (initial kinesiology and final kinesiology examination) the equipment that I used involved:

- Goniometer, for the evaluation of the available range of motion of the associated body segments (lower extremities)
- Measurement tape (for the performance of the anthropometry measurements)
- Neurological Hammer (for the evaluation of the deep tendon reflexes as a part of the Neurological Examination)

The patient was after the undergone of total hip replacement surgical operation and she was using fore-arm type of crutches for supporting her walking.

The patient was fully aware that she was part of my Bachelor Thesis Clinical Practice. All the examinations and therapeutic procedures were performed having the patient aware and respecting the medical post-operative condition of the patient.

My work has been approved by the Ethics Committee of the Faculty of Physical Education and Sports at Charles University the period of 2012 under the approval

Number: 045/2012

Date: 6th of February 2012

3.2 Clinical record of patient

Gender of the examined person: Female

Initials of the examined person: C.N.

Date of anamnesis: The date that the anamnesis of the patient was taken is the 25th of the month January of the year 2012.

Year of birth: 1947 (65 years old of age)

Diagnosis: Primary coxarthrosis, bilaterally. The associated lower extremity is the left one. The patient has undergone a surgical operation of total hip replacement.

Medical Code: M.160

Present State: The patient is three months after the undergone of the surgical operation of total hip replacement on the left lower extremity. The post-operative course for which she has been assigned is taking place without any complication reported. The overall condition of the patient is very satisfactory. The patient is walking by using fore-arm type crutches. The patient is visiting the physical therapy department of the hospital for preventive reasons. She just wants to be in a good condition post-operatively. Also she has still some problems with the balance of her she can't walk without her crutches, but she can stay in standing position without using them. But when she begins to perform any kind of movement from the standing position then she needs some kind of support. The patient is feeling instability in knee joint during gait.

Pain Level: When the patient was asked if she is feeling any kind of pain which is associated with her medical diagnosis and describe the intensity of it she replied that actually there was no pain. So the result is that the pain level of the patient is described as zero out of ten (0/10).

Height: 1.70cm
Weight: 76 Kg
Body Mass Index (B.M.I): 26, 3 nm

Temperature: 36,4^{o}
Breathing Rate: 16 breaths per minute
Blood Pressure: 140/80 (diastolic/systolic)
Pulse: 78 beats per minute

Personal Anamnesis: The following information was retrieved from the medical documentation of the patient:

- Essential [primary] hypertension
- Hypothyroidism [E038]: the patient is attending therapy from the year 2010
- Blended hyperlipidemia [E782]: the patient is attending therapy for the dealing of the problem
- Hemorrhoids
- Not any other kind of injuries
- The patient is characterized as able to orientate inside a place
- She is still performing her professional [she is involved with photographing]

- No fever was recorded during the elaboration of the medical documentation
- No pathology in the area of the neck and of the head
- Pure breathing was recorded (Breathing rate = 16 breaths per minute)
- Regular heart functions were recorded (HR= 78 beats per minute)
- Good percussion
- The area of the belly of the patient is characterized as soft-bolded
- It wasn't found any kind of enlargement on the livers of the patient
- Tapottement sided painless
- The blood supply and innervations to the periphery of the body is performed without any kind of malfunction.
- Varicose veins are located on both lower extremities without any sign of ulcer or inflammation [I839]

Anamnesis/History: The cause of the injury that led to the surgical operation was an accident-falling down. The accident took place on the 28th of October 2011 when the patient tripped and fell on the pavement. The patient injured the left lower extremity – she landed with the left side of her body. Then she was taken to a health center for the performance of the associated examinations. It was then that she was diagnosed with fracture of the left femur bone at the area of the neck. The patient expressed her desire to attend a therapeutic program at her own residence because there she will have also the help of her husband. The patient is then brought to the ambulance department of U.V.N. where she performs examinations of RTG and CT.
Post-operative ad CHJIP from the 28th of October till the 30th of October 2011
After the stabilization of the overall state of the left injured femur she was sent to the orthopedic department. The whole time of her hospitalization extends from the 30th of October till the 4th of November of 2011. From that period of time until now the patient is visiting the ambulance department in U.V.N for attending her rehabilitation program.

Allergy Anamnesis: TTC

Abuses Anamnesis: The patient doesn't smoke. She is only consuming alcohol in special occasions as she described. No other kinds of abuses were mentioned on the medical documentation of the patient e.g. caffeine. The patient doesn't attend some special kind of diet.

Gynecological Anamnesis: The patient has been pregnant once in the past. She has one healthy son as a result of her pregnancy. The year 1999 she underwent a surgical operation of hysterectomy and extirpation of adnexes. No other information concerning her gynecological anamnesis could be found on the medical documentation.

Family Anamnesis: The mother and the grandmother of the patient passed away due to cancer that was located on the pancreas. The mothers died at the age of 79 while the grandmother at the age of 71.

Occupational Anamnesis: The patient used to be a photographer. She is now living with her husband. In their residence there is no available elevator and they are living on the second floor of the neighborhood. She is currently involved with photography

Surgical Operation Anamnesis: The patient had an accident during which a fracture occurred located on the neck of the femur bone of the left lower extremity. That fracture led her to the undergone of the surgical operation of total hip replacement three months ago. There was placed an endoprotesis on the associated area. The stitches have been removed and the post-surgical incision doesn't present any kind of pathological state.
TE during childhood. The surgical operation took place the year 1952.
Hysterectomy

Medicaments Anamnesis: The patient is prescribed for the following medications:

- **Lipanthy**l 267 M CPS
- **Clexane**INJ 0.4ML: is a medication that is used in order to prevent any kind of clot formation in the blood vessels. Can be also found under the name "enoxaparin".
- **Micardis** plus 80/12,5 Mg tablets: used for the treatment of the high blood pressure [D.I.N: 02244344]
- **Euthyrox** 50RG TBL: medication that is prescribed for patients that present hypothyroidism.
- **Ibalgin** 400MG TBL: medication that is used for the analgesic reasons and for dealing with inflammation cases.
- **Stilnox**TBL: medication that is prescribed for the dealing of insomnia

Also in the medical documentation of the patient it was reported that analgesic medication was provided to the patient during her rehabilitation program.

Previous rehabilitation: There was no information from the medical documentation of the patient for any kind of previous rehabilitation.

Statements from the patient's medical documentation: During the performance of my clinical practice I had the opportunity to see the X-ray examination of the patient.

Indication for rehabilitation: The patient was prescribed to attend a rehabilitation program that would include:

- Training of walking – correction of any altered movement stereotype
- Sensomotoric stimulation for the increase of the proprioception of the patient
- Improvement of the balance of the patient
- Correction of the walking pattern of the patient
- Training for self-therapy

Concerning the examinations that should be performed in order to make clearer the direction of the therapy procedures, the associated doctor wanted to be performed:

- Examination of the soft tissues of the lower extremities (and application of the associated therapy depending on the result of the examination)
- Control of any possible muscle imbalance and application of associated therapeutic procedures for correction.

3.3 Initial Kinesiology Examination

Following is a list of the examinations that were performed during the sessions I had with the patient:

1. Postural examination of the patient – ventral, lateral and dorsal view
2. Evaluation of the Gait of the patient (and if possible performance of any modification of the walking stereotype)
3. Examination of the post-surgical incision (observation and application of soft-tissue techniques according to the principles of K. Lewit)
4. Anthropometry measurements applied on the lower extremities (lengths and circumferences) – checking for the presence of swelling in the area of the lower extremities
5. Evaluation of the available range of motion of the lower extremities (performance of passive and active movement) – goniometry
6. Palpation of the muscle groups of the lower extremities for evaluation of their tonicity
7. Strength manual muscle testing of the muscle groups of the lower extremities according to the principles and grading of H.O Kendall
8. Muscle length testing of the muscle groups of the lower extremities according to the principles of H.O Kendall and the grading of V. Janda
9. Neurological Examination
10. Application of joint play examination according to the principles of K. Lewit
11. Examination of the balance of the patient – in sitting and standing position according to the principles of V.Janda

3.3.1 Postural examination of the patient – ventral/dorsal and lateral view

The evaluation of posture was performed while the patient was in standing position. The patient was wearing as much as possible fewer clothes and no shoes or shocks. The views that were evaluated are: the anterior-ventral view, the lateral-side view and the posterior-dorsal view.

Anterior/Ventral View

Distance between the feet	The feet of the patient were close to each other.
Ankle joint	The right ankle joint was presenting swelling
Contour of the calves	The calves weren't symmetrical
Knee joint	Both knee joints were presenting deviation. The left knee joint was presenting a scar on the medial surface of it and the right one was placed higher in comparison with the left. The alignment

	that presents the lower extremities of the patient is that of valgosity.
Thighs	The thighs are not symmetrical
Lower abdomen area	The abdomen area is presenting a slight protraction. The navel is deviated to the right of the body. The navel is on the surface of the abdomen and not in some depth. The lateral contour of the abdominal walls present concave alignment
Anterior Superior Iliac Spine (A.S.I.S.)	The left anterior superior iliac spine was located higher than the right one
Axillary triangle	The right axillary triangle is bigger than the left one
Sternum and pectoral muscles area	The chest area presents symmetry as well good mobility when it comes to the expansion of the thoracic cage during inspiration and the mobility of the ribs. There wasn't any kind of deformity of the associated area [e.g. Barell chest, Pectus Excavatum, Pectus Carinatum].
Clavicle and shoulder girdle area	The right clavicle seems to be slightly higher in comparison with the left one. The right shoulder seemed to be a little bit higher in comparison with the left one, but again the difference was slight.
Head	The head of the patient is slightly deviated to the right in comparison with the rest of the body.

Table no. 05 - Examination by observation of the anterior aspect of the body of the patient – Initial Kinesiology Examination.

Lateral View

The shape of the calves	Both calf areas of the lower extremities of the patient were presenting symmetry from the lateral view of observation
The area of the knee joint	The knee joint of both lower extremities present hyper-extension. The extension of the right lower extremity is in greater degree than the one on the left one.
Buttocks area [tonicity of the glutei muscles]	The glutei muscles of the patient present decreased tonicity. While the gross area of the buttocks present depression.
The abdominal muscles area	There is protraction of the abdominal muscles.
The lumbar part of the spinal cord	The lumbar area of the spinal cord presents

	lordosis. Also in the area going towards the buttock-sacral region of the body there is marked flatness.
The thoracic part of the spinal cord	The thoracic area of the spinal column presents a slight kyphosis, while there is a striking flatness in the same area
The position of the shoulders	The shoulders are slightly protracted.
Chest area / sternum.	The chest area of the patient presents a forward protraction. No sign of flatness is present. No sign of any deformity of the chest/sternum area.
The shape of the spinal column	The normal curvatures that are expected seem to be present in the spinal column of the patient. There are some points that present flatness and there is also cervical kyphosis but generally the shape of the spinal column is good
Position of the head	The head is moving forward in comparison with the rest of the body of the patient

Table no. 06 - Examination by observation of the lateral side of the body of the patient – Initial Kinesiology Examination.

Posterior/Dorsal View

Symmetry [roundness] and position of the heels	The heels present symmetry concerning the roundness of them and they don't have a lot of distance between them. The base of the patient is relatively small. The lower extremities of the patient present valgosity.
Symmetry and thickness of the Achilles tendon	Both Achilles tendons were symmetric. There wasn't some excessive loading on both of them.
Symmetry of the calves area	The calves didn't seem to present symmetry. The difference was observed mainly on the lateral aspect of the left calf area.
Poplittea Fossae symmetry	The poplittea fossa of the left lower extremity is located higher than the right one. Also on the left area of the poplittea fossae are more exposed the varicose veins of the patient
Symmetry of the thigh area	The thighs didn't present symmetry. From the medial aspect the right thigh is deviated more to a medial direction. The left thigh area presents bigger concavity than the right one.

	Generally the right thigh seems to overtaking the left one and that can be seen especially on the caudo-medial part of it
Symmetry of the sub-glutei lines	The left sub-glutei line is higher than the right one.
Symmetry of the tonicity of the glutei area muscles	Both glutei muscles were presenting decreased tonicity.
Symmetry of the iliac crests	The left iliac crest was in a higher position than the right one. (Lateral tilt to the right)
Symmetry of the posterior superior iliac spine (P.S.I.S.)	The left superior posterior iliac spine was higher than the right one
Axillary triangle – Symmetry of the trunk outline.	The right axillary triangle is bigger than the left one. That can be seen mostly on the area near the inferior angle of scapulae and near the pelvic crests.
Position of the inferior angle of the scapulae	The right scapula is placed more caudally in relation to the left one.
Position of the medial margin of the scapulae.	The right scapula presents abduction. On the other hand the left scapula presents adduction towards the spinal column.
Symmetry of the shoulder joint position	The left shoulder is placed in a higher position than the right one
Symmetry of the auricles	The left auricle is placed higher than the right one
Position of the head	The head is rotated to the left compared with the rest of the body of the patient

Table no. 07 - Examination by observation of the posterior view of the patient's body – Initial Kinesiology Examination.

3.3.2. Gait examination – and performance of any possible modifications

For the performance of the gait the patient was in need of using her crutches. No sign of dizziness or any other complaint was recorded during the execution of the examination.

The patient is using the three point walking stereotype
The patient seems to be confident while walking with the crutches
There is a small rotational movement of the pelvis in the right and left direction
No movement of the shoulder area [soldier like position of the upper part of the trunk which is adopted the whole time of the walking]

Deviation of the body to the right [that deviation was observed during the postural evaluation and is adopted also in the walking stereotype].
There is no full extension of the lower extremity in the area of the knee joint during the performance of the steps
The steps that the patient performs are symmetrical but big enough
The velocity with which the patient is walking could not be characterized as nor fast neither slow
There is full contact of both feet on the floor
During the performance of steps the first contact with floor was performed with the heel and then the rest of the plantar surface of the foot
The right lower extremity was performing bigger step than the left lower extremity

Table no. 08- Gait Examination and performance of any possible modification – Initial Kinesiology Examination

3.3.3 Examination of the post-surgical incision/scar (Observation and application of soft-tissue techniques according to K. Lewit)

The application of the soft-tissue techniques took place while the patient was on the examination bed in supine position. The procedures were performed according to the principles of K. Lewit and the only contraindication was the pain that the patient might feel. Nevertheless no pain or any other complaint from the patient was recorded during the performance of the examination. The scar is located on the left lower extremity, on the lateral/cranial part of the thigh. The length of the post-surgical scar is approximately 15cm. By examining the scar by observation there wasn't any kind of swelling, secretion or bleeding. The stitches have been removed. The color of the area where the post-surgical incision is located as well other characteristics as temperature and contour doesn't present any great difference in comparison with the rest of the lower extremity. The movements that were performed were: skin stretching into all the possible directions, stretching a connective tissue fold and sustained application of pressure in the associated area. The result of the examination was that the scar mobility was satisfactory with no restriction in any direction.

3.3.4 Anthropometry measurements applied on the lower extremities (lengths and circumferences) – checking for the presence of swelling on the L.E.

The application of the measurements was performed while the patient was on the examination bed in supine position. The associated body parts were as much as possible naked during the performance of the examination. No sign of pain or some other complaint was recorded during the performance of the anthropometry measurements. The following evaluations took place:

- Length of the whole lower extremities
- Length of the individual segments of the lower extremities (calf/thigh/small foot area)
- Circumference of the individual segments of the lower extremities (thigh/knee joint/calf/ankle joint/metatarsals)

Length of the whole Lower Extremity

Measuring parameter	Right L.E. (Dx.)	Left L.E. (Sin.)
Anatomical Length	81cm	81cm
Functional Length [measured from the umbilicus]	98cm	98cm
Functional Length [measured from the A.S.I.S]	97cm	97cm

Table no. 09 - Anthropometry measurements – Evaluation of the length of the whole L.E – Initial Kinesiology Examination. (cm)

Length of the individual parts of the Lower Extremity

Measured body segment	Right L.E (Dx.)	Left L.E (Sin.)
Thigh	40cm	40cm
Calf	42cm	43cm
Small foot area [metatarsals]	25cm	25cm

Table no. 10– Anthropometry measurements – Evaluation of the length of the individual parts of the L.E – Initial Kinesiology Examination. (cm)

Circumferences of the lower extremity

Measured body segment	Right L.E (Dx.)	Left L.E (Sin.)
Thigh [measured 10cm above patella – for checking Vastus Medialis for any possible hypotrophy]	44,5 cm	45,5 cm
Thigh [measured 15cm above patella – for checking Quadriceps Femoris m. as a whole]	46,5 cm	46,5cm
Patella – Knee joint	41.5	42
Calf [measured on the site if the highest volume]	37	37
Ankle joint	25,5	26
Metatarsals	22	23

Table no. 11- Anthropometry measurements – Evaluation of the circumferences of the L.E – Initial Kinesiology Examination. (cm)

3.3.5 Palpation of the muscle groups of the lower extremities for the evaluation of their tonicity

The performance of palpation took place while the patient was on the examination bed in supine position. The patient was relaxed and there wasn't any kind of complaint recorded such as pain or some other unpleasant feeling during the whole examination.

No change in the temperature of the operated lower extremity was recorded concerning the area where the post-surgical incision was located and the rest of the body segment.

Results:

Examined muscle	**Right L.E. (Dx.)**	**Left L.E. (Sin.)**
Tibialis Anterior muscle	Normal tonicity	Normal tonicity
Tibialis Posterior muscle	Decreased tonicity	Decreased tonicity
Soleus muscle	Decreased tonicity	Decreased tonicity
Gastrocnemius muscle	Decreased tonicity	Decreased tonicity
Rectus Femoris muscle	Increased tonicity [especially near the insertion of the tendon of the muscle into the patella]	Increased tonicity [especially near the insertion of the tendon of the muscle into the patella]
Vastus Medialis muscle	Decreased tonicity	Decreased tonicity
Vastus Lateralis muscle	Decreased tonicity	Decreased tonicity
Biceps Femoris muscle	Increased tonicity [mainly on the lateral and cranial part of the muscle]	Increased tonicity [mainly on the lateral and cranial part of the muscle]
Semitendinosus muscle	Normal tonicity	Normal tonicity
Semimembranosus muscle	Normal tonicity	Normal tonicity
Tensor Fasciae Latae muscle	Increased tonicity	Increased tonicity
Adductor Brevis muscle	Increased tonicity	Increased tonicity
Adductor Longus muscle	Increased tonicity	Increased tonicity
Gluteus Medius muscle	Decreased tonicity	Decreased tonicity
Gluteus Maximus muscle	Decreased tonicity	Decreased tonicity

Table no. 12– Palpation of the muscle groups of the L.E for the evaluation of their tonicity – Initial Kinesiology Examination.

3.3.6 Evaluation of the available range of motion (R.O.M) of the Lower Extremities according to the principles of H.O. Kendall

The examination performed according to the principles of H.O. Kendall. For the associated evaluation a goniometer was used. No pain or any other kind of unpleasant feelings were recorded from the patient. The evaluation of the range of motion of the lower extremities was performed according to the unilateral method of S.F.T.R. The movements were performed in a passive and active way.

The patient was in supine position on the examination bed for the evaluation of the range of motion. The body segments where the examination/evaluation took place were as much as possible naked.

Movements: Flexion and Extension

Extension – 0 – Flexion	**Right L. E. (Dx)**	**Left L.E. (Sin)**
Active Movement	**S** 0^0 – 0 – 105^0	**S** 0^0- 0 – 100^0
Passive	**S** 0^0- 0 – 110^0	**S** 0^0- 0- 115^0

Table no. 13 - Evaluation of the available range of motion of the Lower Extremities according to H.O. Kendall - Flexion/Extension - Initial Kinesiology Examination.

Movements: Abduction and Adduction

Abduction – 0 – Adduction	**Right L. E. (Dx)**	**Left L. E. (Sin)**
Active Movement	**F** 40^0- 0- 10^0	**F** 35^0-0-10^0
Passive Movement	**F** 45^0-0-15^0	**F**40^0-0-15^0

Table no. 14 – Evaluation of the available range of motion of the Lower Extremities according to H.O. Kendall – Abduction/Adduction - Initial Kinesiology Examination.

Movements: External Rotation and Internal Rotation

External Rotation – 0 – Internal Rotation	**Right L. E. (Dx.)**	**Left L. E.(Sin)**
Active Movement	**R** 40^0-0-30^0	**R** 40^0-0-20^0
Passive Movement	**R** 45^0-0-40^0	**R** 45^0-0-35^0

Table no. 15 – Evaluation of the available range of motion of the Lower Extremities according to H.O. Kendall– External/Internal Rotation - Initial Kinesiology Examination.

3.3.7 Manual muscle strength testing of the muscle groups of the lower extremities according to the principles and grading of H.O Kendall

The muscle strength testing was performed according to the principles and grading of H.O. Kendall. No pain or any other complaint was recorded during the performance of the examination.

The starting position that the patient was adopting varied depending on which muscle or muscle group was evaluated.

Examined muscle	**Right L.E. (Dx.)**	**Left L.E. (Sin.)**
Hamstrings group of muscles	4	4
Gluteus Maximus m.	3	3
Quadriceps Femoris m.	4	4
Iliopsoas m.	4	4
Adductors group of muscles	3	3
Abductors group of muscles	3	3
Tibialis Anterior m.	4	4

Triceps Surrae m.	3	3

Table no. 16 – Manual muscle strength testing of the muscle groups of the lower extremities according to the principles and the grading of H.O. Kendall – Initial Kinesiology Examination.

3.3.8 Muscle Length test of the muscle groups of the lower extremities according to the principles of H.O. Kendall and the grading of V. Janda

The patient is in a post-surgical state. The surgical operation took place approximately three months ago [28th of October 2011]. That makes the patient able to perform the examination of the length of the associated muscle groups of the lower extremities without being exposed in any possible damage of the operated area. No pain of any other complaint was recorded during the performance of the examination. The only thing that the patient mentioned was that she doesn't feel any difference between the two lower extremities or any kind of limitation on the activities of hers.

Evaluation of the Length of the muscle groups

Measured muscle group	**Right L.E (Dx)**	**Left L.E (Sin.)**
Rectus Femoris muscle	No shortness	No shortness
Iliopsoas muscle	No shortness	No shortness
Tensor Fasciae Latae	Slight [moderate] shortness	Slight [moderate] shortness
Hamstrings group of muscles	Shortness	Shortness

Table no. 17– Muscle Length test of the muscle groups of the lower extremities according to the principles of H.O. Kendall and the grading of V. Janda – Initial Kinesiology Examination.

3.3.9 Application of joint play examination according to the principles of K. Lewit

Performance of:

- Examination of tibio-fibular joint in ventral/anterior and dorsal/posterior direction
- Examination of the patella in all directions [medial-lateral-caudal-cranial]

The examination took place while the patient was in supine position on the examination bed. The procedures were done according to the principles of K. Lewit and the ten general principles concerning the position of the patient and the examiner. No pain or some other unpleasant feeling was recorded by the patient during the performance of the examination.

Results:

Examined body segment	**Right L.E. (Dx.)**	**Left L.E. (Sin.)**
Tibio-fibular joint [movement into anterior	No restriction was found	No restriction was found

and posterior direction]		
Patella [movement into all directions]	Restriction was found into the performance of the movement into the lateral direction. As well the movement into caudal and cranial direction was not in the same range as in the left lower extremity. The movement of the patella into the medial direction wasn't restricted.	No restriction was found

Table no. 18– Application of manual methods in tibio-fibular joint and patella according to K. Lewit – Initial Kinesiology Examination.

3.3.10 Examination of the balance of the patient – in sitting and standing position according to the principles of V. Janda

The examination of the balance of the patient was performed in sitting and in standing position.

Sitting position

In the sitting position the patient was placed near the edge of the examination bed with the lower extremities being hanging down. After asking the patient if she is feeling somehow dizzy or something else that she wanted to mention and explaining her the whole procedure I proceeded into the execution of the examination. In the sitting position I provided pressure on the body of the patient in different directions while at the same time the patient was trying to retain her position and not lose balance. Then we tried that examination while the patient had closed eyes. Firstly the patient had a small difficulty but then the result of the modification was the same as before, the patient had a very good stability. The same examination took place in the lower extremity while the patient was in sitting position and in standing position

Standing position

Firstly there was the correction of the posture and then the examination of the balance of the patient. Firstly performed with opened eyes and then with closed eyes. The patient should try to retain her stability and initial position no matter the pressure that I was providing to her in different direction. The important thing about that particular exercise is that the patient shouldn't be providing counter pressure to the pressure that I was providing to her.

3.4 Conclusion of the initial kinesiology examination

After the performance of the initial kinesiology examination we can concentrate in some major observations and guide our therapeutic approach.

The examination by observation of the patient indicated some muscle imbalances that could be corrected.

The examination of the gait even though exposed some quite positive characteristics of the gait of the patient such as the confidence and a correct usage of the crutches and the walking pattern, showed the main reason that the patient needs the application of a physical therapy program. The reason is that the patient as her complaint during the performance of the walking she doesn't feel the knee joints stable. That can be combined with the results of the joint play examination on the associated joints that indicated some kind of restriction on the right patella especially to the lateral direction.

The results of the application of anthropometric measurements showed that there are not big differences concerning the length and the circumferences of the two lower extremities. The numbers show us that there is no swelling on the lower extremities or some major difference between the lengths due to the nature of the surgical operation that was performed.

The palpation showed that most of the muscle groups of the lower extremities present decreased or normal tonicity, and in some cases there were also muscles presenting increased tonicity.

The muscles of the lower extremities present enough muscle power for the performance of the walking and the several exercises. Even though that there are a couple of muscle groups that could need some strengthening exercises, the strengthening should be an important part of the therapy program but not the most important for the current state of the patient.

The length testing of the muscles indicated mainly the Hamstring group of muscles and the Tensor Fasciae Latae to present shortness

The neurological examination didn't show something different from the already known statement of the medical documentation of the patient

3.5 Short and long term rehabilitation plan

3.5.1 Short-term rehabilitation plan

Taking in consideration the nature of the surgical operation that the patient underwent we should focus on the rehabilitation of the operated side of the body [left lower extremity]. According to the statements of the patient no pain is experienced during the execution of the exercises in the medical center or during the performance of the daily living activities in the residence of the patient. So the short-term rehabilitation plan should contain the following therapeutic procedures:

- Performance of active movements e.g. flexion/extension of lower extremity in the hip joint, ER/IR, in order to maintain and increase the range of motion of the lower extremities
- Strengthening exercises for the adductors, gluteal and calf muscles
- Performance of post-isometric relaxation techniques for the muscles with increased tonicity according to K.Lewit
- Stretching techniques applied for the muscle groups that present shortness (Hamstring group of muscles & Tensor Fasciae Latae)
- Correction and improvement of the posture of the patient according to the principles of V. Janda

- Increase of the sensory perception of the patient manually or with the use of special equipment according to V. Janda
- Exercises for the prevention of falling/ performance of lunges according to V. Janda
- Performance of as much as possible walking with the correct stereotype [3 point walking type] – also walking upwards and downwards on stairs.

3.5.2 Long-term rehabilitation plan

After the end of the sessions with our patient the following rehabilitation plan should include:

- General maintenance of a good condition of the muscle strength, of the posture and of the range of motion of the patient.
- Improvement of the gait – walking stereotype of the patient
- Exercises for aiming the increase of the proprioception-improvement of the sensory motor stimulation
- Improvement of the walking stereotype when walking forward, and when walking on stairs
- Showing exercises that the patient can perform by herself in her residence like self-therapy

3.6 Therapy Progress

3.6.1 First Session - Monday 16th of January 2012

Present State
That was the first day that I consulted the patient. The patient is using crutches for her transport. No pain was recorded concerning the operated lower extremity and hip area. The main reason the patient is consulting the physical therapist is for the full recovery concerning the balance of her. Also the patient mentioned that during the walking she doesn't feel her knee joint to be steady.

Control Examination
That day the initial kinesiology examination was performed. So I already had the results of the associated examinations I wanted in order to proceed to the therapy

Goals of today's therapy unit

1. Mobilization of the patella in all the directions according to the principles of K. Lewit – Joint Play
2. Performance of active movements in order to improve the range of motion of the lower extremities
3. Strengthening of the muscle groups that present weakness with the use of therra-band elastic exercise band and over-ball equipment
4. Application of post-isometric relaxation techniques according to the principles of K. Lewit for the muscle groups that presented increased tonicity
5. Exercises for stretching the muscles that present shortness

6. Improvement of the balance of the lower extremities and of the upper trunk of the patient according to the principles of V. Janda.
7. Exercises for the improvement of the sensory perception according to V. Janda
8. Correction of the posture in standing position in stable surface according to V. Janda.
9. Teaching exercises for the patient to perform by herself in a way of self-therapy

1. Mobilization of the patella in all the directions according to the principles of K. Lewit – Joint Play

The patient was on the examination bed in supine-lying position. The lower extremities of hers were relaxed and straight in the area of the hip and the knee joint. From the initial kinesiology examination, the outcome regarding the mobility of the patella was that the one on the right lower extremity was presenting a small restriction during the performance of the movements. The restriction was notice-able especially towards the lateral direction.

The mobilization of the patella was performed by covering with both hands the patella and providing the circular movements in all the possible directions (medial, lateral, caudal and cranial). The performance of the mobilization was done on both lower extremities

2. Performance of active movements in order to improve the range of motion of the lower extremities

At the beginning the patient was in supine-lying position on the examination bed. The lower extremities of the patient were relaxed and straight in the area of the hip and the knee joint. The upper extremities of the patient were also relaxed and the low back area of the trunk was in contact with the examination bed.

At the beginning I performed all of the movements of the lower extremities passively. Since the patient had enough muscle power – also proven during the initial kinesiological examination I asked her to perform by her own –actively the following movements:

- Flexion/Extension of the lower extremities in the area of the hip joint
- Abduction/Adduction of the lower extremities in the area of the hip joint
- Internal/External Rotation of the lower extremity in the area of the hip joint
- Flexion/Extension of the lower extremity in the area of the knee joint
- Plantar and Dorsal Flexion of the ankle joint.

3. Strengthening of the muscle groups that present weakness with the use of therra-band and over-ball equipment

The strengthening exercises were aiming into the improvement of the condition of the following muscles:

- Tibialis Posterior muscle
- Gastrocnemius and Soleus muscles (Triceps Surrae m.)

- Gluteus Medius and Gluteus Minimus
- Adductor group of muscles (Adductor Longus & Brevis and Pectineus)

Strengthening of Tibialis Posterior muscle & Triceps Surrae m.

For the strengthening of the associated muscles there were performed exercises with the use of elastic exercise band and an over-ball

The patient was in lying-supine position on the examination bed with the lower extremities being straight in the area of the knee joint. A therra-band of yellow color and mild resistance was used for that particular exercise. The therra-band was wrapped around the area of the tarsals of the patient. The other edges of the therra-band were held from the patient.

From that position the patient was performing plantar flexion of the ankle joint against the resistance of the therra-band elastic band. Since the associated muscle is responsible also for the performance of inversion of the foot that exercise could be performed with the use of an over-ball (located beneath the area of the heel of the small foot) or by simply adding the component of inversion to the whole exercise
Repetitions of the exercise: 10 repetitions. The particular exercise is very simple and the patient is able to perform it while she is in her house by herself even during her leisure time or relaxation time during the day.

Strengthening of Gluteus Medius and Minimus

The strengthening of the associated muscles was performed through a series of different exercises during the sessions I had with the patient.

Exercise no. 1

The patient was in standing position. The lower extremities are apart and the heels are hip width apart. The patient is using her upper extremities in order to gain more support during that position. The hands of her are in contact with the wooden bars that were located on the room where the session was taking place. The upper extremities of the patient presented a slight flexion in the area of the elbow joint – straight back.

The patient is performing abduction of each lower extremity in the area of the hip joint. At the same time the patient tries to retain her back area as straight as possible – avoiding performing excessive lateral flexion to the side.
Repetitions: It should be repeated about 10 times for each lower extremity, X 2

Exercise no. 2

The patient is in supine position on the examination bed. The upper extremities are relaxed along the trunk of his/her. The low back area of the body is in contact with the

surface of the examination bed. The lower extremities are presenting flexion in the area of the knee and hip joint.

An overball is placed between the flexed lower extremities of the patient in the height of the knees. The patient is providing pressure to the over-ball in the direction of the adduction of the lower extremities in the area of the hip joint. At the same time there is elevation of the pelvic region. The patient is trying to put the bones of the anterior superior iliac spine in lateral direction and contracts the gluteal muscles.

Exercise no. 3

The patient is on the examination bed in side-lying position. The lower lying lower extremity is straight in the area of the hip and the knee joint. The upper lying lower extremity is presenting slight flexion of the knee and the hip joint. The upper trunk is relaxed on the surface of the examination bed and the upper extremities are used in order to give support/stabilize the whole body

From that position the patient is performing abduction of the lower extremity in the area of the hip joint. The particular exercise is actually the same as the one that was performed while the patient was in standing position. The new position is providing more comfort to the patient as the upper trunk is fixed and there is no the need of controlling for any exceeding of lateral flexion.
Repetitions: 10 repetitions X 2

Strengthening of Adductor group of muscles (Adductor Longus & Brevis – Pectineus)

The patient was in supine position on the examination bed. The lower extremities of hers were relaxed neutral in any kind of movement such as flexion/extension or rotation. The upper extremities were relaxed along the trunk of the patient

Exercise no. 1

For the particular procedure a therra-band of yellow color/mild resistance was used. I placed the therra-band around the area of the thigh of the patient just above the knee joint area. I was in standing position next to the examination bed from the side of the operated lower extremity and I asked the patient to perform adduction of the lower extremity in the area of the hip joint. The exercise was performed for both lower extremities.
Repetitions: 10 times x 2

Exercise no. 2

The strengthening of the hip adductors was done also during the previously described exercise for the strengthening of the gluteus medius and minimus since there was the

isometric contraction of the lower extremities against the over-ball placed between the flexed knee joints.

4. Application of post-isometric relaxation techniques for the muscles with increased tonicity (bilaterally) according to the principles of K. Lewit

Rectus Femoris muscle

The patient was in a prone-lying position on the examination bed. Both lower extremities were in straight position in the area of the knee and hip joint. The upper extremities of the patient were relaxed along the trunk of the patient.

The patient brought the associated lower extremity in a position of flexion in the area of the knee joint. Resistance was provided against the lower extremity of the patient in the direction of flexion in the area of the hip joint, and the steps of the post-isometric relaxation technique were followed:

1. Providing slight counter-pressure against the examiner
2. Breathing in deeply and slowly
3. Hold the breath
4. Breath out and relax
5. Bringing the muscle into a position that is characterized by maximal elongation

Biceps Femoris muscle

The patient was in supine-position on the examination bed. The lower and the upper extremities were relaxed along the trunk of the patient. The low back area of the patient was in contact with the examination bed. I was in standing position on the end of the examination bed.

During the procedure I used my right hand for the right lower extremity of the patient and the same procedure respectively for the left lower extremity. I brought the lower extremity in a position that presents:

- Adduction in the area of the hip joint
- Stretched in the area of the knee joint, and internally rotated in the area of the hip joint

Then I followed the steps of the P.I.R. technique as were performed in the previous exercise

Tensor Fasciae Latae muscle

For the treatment of the Tensor Fasciae Latae muscle gravity-induced therapy was applied

The patient was in side-lying position near the edge of the examination bed. The lower lying lower extremity was placed in a position of flexion in the area of the hip and knee joint while the upper lying lower extremity was placed like this that it was over the

previously described lower extremity and hanging down from the examination bed. The upper extremities of the patient are presenting flexion in the area of the elbow joints in that way that they provide stability to the rest of the body of the patient.

From that position the patient is following the associated steps of the post-isometric relaxation technique. In that case the component of resistance is provided by the impact of the gravity. The only intervention that I had during that procedure was to correct the position of the trunk of the patient.

5. Exercises for stretching the muscles that present shortness

During the initial kinesiology examination the muscles that presented a state of shortness were:

- Hamstring group of muscles &
- Tensor Fasciae Latae

Exercises for stretching the Hamstrings group of muscles

1. **Gently Hamstring Stretch**
   The patient should be on the examination bed in supine-lying position. Places the hands around the area of the thigh and brings the associated lower extremity towards the head of hers. The lower extremity shouldn't be completely straight in the area of the knee joint as the elevation takes place. The patient is inhaling and exhaling while she performs the exercise.
   Repetitions: 4→5 times

2. **Before sport activity hamstring stretching**
   Patient is in standing position. The one lower extremity is in front of the other lower extremity and the patient then places the hands on the area of the hips. The back should be kept straight. The patient is then starting to bend forward. To increase the stretch of the front lower extremity the lower part of the back move inwards and n that way the abdomen moves closer to the ground. Hold in that position for approximately 15→30 seconds and repeat 2→3 times for each lower extremity.

3. **Standing Hamstring Stretch**
   The patient is in standing position. She is placing the associated lower extremity on a chair, fence or a table. It is important to keep the back straight and the stretched lower extremity slightly flexed in the area of the knee joint. Then the patient is moving her trunk a little bit forward. Try to keep the lower extremity that is on the ground looking forward.

Exercises for stretching the Tensor Fasciae Latae muscle

1. **Standing stretching of TFL**
   The particular exercise is very easy to perform. It is possible for the patient to perform even into a room that there is not available too much space and enables the patient to use her upper extremities for support. The patient

should be in standing position. During that position performs crossing of e.g. the left lower extremity over the right one. At the same time performs a slight lateral flexion to the right enabling the muscle from the left side to stretch completely.
Repetitions: 4→5 times

2. **Side-lying stretching**
   For that the patient needs to be in side-lying position on the examination bed or any kind of mattress. The one lower extremity of the patient is on the examination bed in neutral position concerning the movements of flexion/extension in both hip and knee joint. The upper lying lower extremity is placed in a position of flexion of 90^0 in the hip and the knee joint. The trunk of the patient is slightly rotated in that way that will support the position of the lower extremities. With the one hand the patient is allowed to pull the upper lying lower extremity so that will lead the associated Tensor Fasciae Latae muscle into further extension.
   Repetitions: 4→5 times

6. Improvement of the balance of the lower extremities and of the upper trunk of the patient according to the principles of V. Janda

For the lower extremities: The exercises aiming in the improvement of the stability of lower extremities were performed while the patient was in sitting and supine-lying position on the examination bed.

Exercise no. 1

The patient is in supine-lying position on the examination bed. The associated lower extremity of the patient present flexion in the area of the knee joint approximately 100^0 and flexion in the area of the hip joint approximately 45^0. The rest of upper extremities of the patient are along the trunk and the low back area is in contact with the surface of the examination bed. An over-ball is placed under the heel of the patient. So at the end of the starting position the associated lower extremity should be on an over-ball and flexed in the area of the hip and knee joint

I asked the patient to try to keep the lower extremity still. I didn't want her to provide counter-pressure against my pressure, but instead retain the starting position of the lower extremity. I provided pressure in different directions on the lower extremity. The same principles and performances were performed on the other lower extremity as well.

Exercise no. 2

The patient is again in supine position on the examination bed. The starting position of that exercise is the same as before. The lower extremities are presenting flexion in the area of the knee and hip joint, while the trunk and the low back area are in contact with the examination bed. The only difference with the previous exercise is that the over-ball is now placed between the flexed lower extremities of the patient at the height of the knee joints.

From that position I asked the patient to try to elevate her pelvis and keep it elevated for 10s.

Exercise no. 3

The patient was in sitting position on the examination bed. Both lower extremities were hanging down from the examination bed, but the heels were in contact with the floor. The trunk of the patient was in upright and straight position.

The same principles as before were followed. I applied pressure on the lower extremities of the patient in different directions. The patient should try to retain the starting position of the lower extremities without trying to counter-pressure my pressure.

Exercise no. 4

The patient was in sitting position on the examination bed, near the edge of it with both lower extremities being hanging down from the edge of it. The upper trunk of the patient was straight in an upright position.

I performed pressure on the upper trunk of the patient in different directions. At the beginning the patient misunderstood the exercise and she was trying to counter-pressure the application of my pressure. After explaining to her we tried again to perform the exercise. The patient understood the essence of the exercise and she was trying to retain her stability no matter the pressure that I was providing to her.

The exercise was continued by having the patient in standing position and performing the same exercise.

7. Exercises for the improvement of the sensory perception according to V. Janda

Exercise no. 1

The patient was in prone-lying position on the examination bed. The lower extremities were relaxed and the ankle joints were sticking out of the examination bed. A cushion was placed on the lower extremities of the patient at the point of calves in order the patient to be more relaxed and the ankles be more elevated so the interaction with them would be easier for us.

Circular movements were performed manually along the whole plantar surface of the foot of the patient. The movements were performed in that way that the three points of the maximum proprioception (heel, and lateral part of the first and the fifth tarsal bone) in the plantar surface of the foot would be irritated. After the performance of the manual-circular movements on the plantar surface of the foot a similar procedure followed but this time instead of using my own hand, I used a specially designed small ball that was having nails on it’s surface. The principles were the same as before.

Exercise no. 2

The patient was in sitting position on the examination bed with the lower extremities being hanging down. The lower extremities were touching the floor. The exercise that was performed was the small (short) foot exercise according to the principles of V. Janda. The patient hadn't performed before the particular exercise, so the application of it was performed first in passive model and then semi-active and then actively:

- **Passive modeling of the small foot**
  The patient should be in sitting position with one foot placed a little more forward than the other one. The whole sole of the foot was in contact with the floor. Then I cupped with one hand the heel area of the foot and with the other hand I cupped the forefoot from above squeezing gently the first and the fifth metatarsals. Then with vibratory movements I shortened and lengthen the sole of the foot of the patient

- **Assistive active modeling of the small foot**
  The patient was in the same position as before (standing on the edge of the examination bed). The manual contacts that I performed were the same as in the procedure before. The patient tries to perform the exercise the same way as he/she did before. My contribution in that way of performing the exercise was to provide stimulation on the dorsal aspect of the forefoot. Also I was trying to correct the whole movement with slight pressure on the toes from above also preventing the performance of flexion.

- **Active modeling of the small foot**
  The difference of that way of performing the exercise is that now the patient models the small foot and the whole narrowing process by herself. Each time she tried the narrowing of the small foot then I was asking her to relax the foot muscles and then try again. The exercise can be performed also with the patient in standing position but we didn't perform that exercise because it was the first consultation with the patient.

8. Correction of the posture in standing position in stable surface according to V. Janda

Because that was the first time that I was consulting the patient and performing the associated exercise I wanted the correction of the posture to take place in a stable surface. Depending on how will be the performance of the patient we will proceed to less stable surfaces like e.g. rocker boards.
The patient was in standing position. The position that the patient adopted is characterized as zero position with the upper extremities being hanging relaxed along the trunk of the patient.

The following instructions were given to the patient in order to correct the posture and try to follow them:

- The feet should be parallel to each other and hip-width apart – the toes are pointed forward

- The patient leans a little bit forward so that the weight is transferred over the ankle joint – the aim of that stage is to obtain an alignment between the lower extremities, the pelvis, the trunk and the head
- Then the patient should flex a little bit (approximately 20^0) the lower extremities in the area of the knee joint and perform a slight external/lateral rotation at the area of the hip joint. During that step the foot's position hasn't changed.
- The patient should try to control the area of the pelvis and abdomen – and perform elongation of the spinal cord
- Controlling of the shoulders and relaxation of the upper extremities
- Finally a correction of the position of the head is performed. The manual contact is with one hand on the chin of the patient and the other one on the site of the occipital bone.

After the obtaining of the new position I asked the patient to try to stay in that position for a little bit. No sign of dizziness or any kind of pain was recorded.

Teaching exercises for self-therapy

The exercises that I advised the patient to perform by herself during the day were:

- The small foot: The patient seemed to understand completely how the exercise of the small foot should be performed. I asked her to try to perform by herself the active elongation of the small foot. That exercise may be provided each time that she is sitting position while she is doing some other activity e.g. watching television or knitting e.t.c.
- Ankle pumps: That kind of exercise would mainly assist into the maintenance and the improvement of the available range of motion on the associated body segment. In case the patient can perform the exercise with the use of a therra-band for the providence of counter-pressure that would be very helpful considering the strengthening of the muscles Tibialis Posterior and Triceps Surrae m.
- Strengthening of the gluteus and medius: The strengthening of the glutei muscles in standing position can be very easily performed at home by the patient. The only parameter that should be taken in consideration is the patient to have something for support in front of him/her.
- In case the patient feels able and she wants to perform some more demanding exercises, then she could combine the performance of the previous described exercises with the use of a therra-band elastic band equipment e.g. The patient may be in standing position having a chair in front of her in order to gain support. The patient is placing a therra-band elastic band on one of the foot of the chair and the other end is placed on the associated lower extremity in the height of the ankle joint for example. From that point the patient is performing abduction of the lower extremity in the area of the hip joint.

Results (objective and subjective) of the first session

The patient is very co-operative, which is something that worked well also for me letting me to provide a lot of exercises and feel comfortable. The patient was satisfied with the therapeutically program of the first day. It is very soon to ask her from now how she sees the whole program or if she would like to change something. For now I

know as she declared that she didn't feel any kind of tiredness or unpleasant feeling during the session. Our session lasted approximately 30 minutes including the initial kinesiology examination and the therapy.

The patient has a very good stability as seen after the performance of the associated exercises. The condition of the muscle power is satisfactory. There are a couple of muscle dysbalances when it comes to the length of some of the muscles as well the tonicity. One very positive fact was that the patient could very easily adapt to the correction of the posture and retain those changes. Some sensomotoric exercises were performed in order to increase the sensory perception of the lower extremities and that seemed to have results and that's the reason why the exercise was performed in sequence with the correction of posture. No pain or some other kind of unpleasant feeling was recorded during the therapy session.

3.6.2 Second Session - Wednesday 18th of January 2012

That was the second time that I consulted the patient. The session was done two days after the last one.

Present State
The patient is still using the crutches (forearm-type). When I asked her if she is feeling stable during her walking she answered me that she doesn't have any problem during the walking with the performance of the activity –especially since she is using the crutches. The only thing that she mentioned is that during the walking she doesn't feel stable both knee joints and especially the right one. There is no pain in the associated area where the surgical operation took place. She is able to perform all the activities of daily living without any kind of problem or noticeable restriction. In the question if she performed in her home the self-therapy exercises, she replied that she did only the small-foot one.

Control Examination
Since the patient complained again for the instability of the knee joints I wanted to perform some brief examination concerning only the joint play that is present on the associated joints:

- Examination of the joint play of the knee joint in all the possible directions according to the principles of K. Lewit
- Length testing of the muscles of the lower extremity
- Strength testing of the muscles of the lower extremity

Since that was the second day of consulting the patient I didn't have the need to perform some other kind of control examination. I believe that the results will not differ so much in comparison with the previous session.. On the next session (in two days) a more detailed control examination will be performed

1. Examination of the joint play of the knee joint in all the possible directions according to the principles of K. Lewit

During the examination of the joint play of the knee joints of both lower extremities the results were pretty similar with the previous time. The mobility of the left knee joint was better compared with the mobility of the right knee joint. The right knee joint presents still some restriction considering the sliding movements.

Goals of today's therapy unit

1. Mobilization of the knee joint of both lower extremities in all the possible directions according to the principles of K. Lewit – Joint play
2. Active movements of the lower extremities for the maintenance and improvement of the available range of motion
3. Stretching exercise for the muscles that presented some shortness
4. Application of post-isometric relaxation techniques for the muscles that present increased tonicity according to the principles of K. Lewit
5. Strengthening exercises for the associated group of muscles of the lower extremities
6. Exercises for the improvement of the balance of the patient according to V. Janda
7. Exercises for the increase of the sensory perception of the lower extremities of the patient according to V. Janda
8. Correction of the standing position of the patient in stable surface

1. Mobilization of the knee joint of both lower extremities in all the possible directions according to the principles of K. Lewit – Joint Play

The procedure of the mobilization of the knee joint was performed in the same way as it was the previous session before two days. That includes the same starting position for the patient as well the position of the therapist. The directions to which the mobilization was performed were: lateral, medial, caudal and cranial.

2. Active movements of the lower and upper extremities for the maintenance and improvement of the available range of motion considering all the extremities

The exercise took place while the patient was in supine position on the examination bed. The movements concerned exclusively the lower extremities and were performed actively by the patient:

- Flexion/Extension of the L.E. in the area of the hip joint
- Abduction/Adduction of the L.E. in the area of the hip joint
- Internal/External rotation of the L.E. also in the area of the hip joint
- Plantar/Dorsal flexion of the ankle joint (similar to the ankle pumps exercise)

3. Stretching exercises for the muscles that presented some shortness

Stretching exercises were performed for the following muscles of the lower extremities:

1. Tensor Fasciae Latae and

2. Hamstring group of muscles

The stretching exercises that were performed for the Hamstring group of muscles included:

- Gently hamstring stretching
- Before sport activity hamstring stretching and
- Stretching of the hamstring group of muscles in standing position

The other muscle that was stretched was the tensor fasciae latae. The exercises that performed were:

- Stretching of tensor fasciae latae in standing position and
- Stretching of tensor fasciae latae in side-lying position on the examination bed.

The performance of the exercises were performed smoothly with not any kind of problem

4. Application of post-isometric relaxation techniques for the muscles that present increased tonicity

The application of the post-isometric technique was performed for the following muscles:

1. Rectus Femoris – bilaterally
2. Biceps Femoris – bilaterally and
3. Tensor Fascia Latae – bilaterally

The principles that were followed were according to the principles of K. Lewit and included the following steps for each of treated muscle:

1. Providing slight counter-pressure against the associated body segment
2. The patient is breathing in deeply and slowly
3. Holds the breath
4. Breaths out and relaxes
5. Bringing the muscle into a position that is characterized by maximal elongation – wait the required time in order to achieve that position of maximal elongation.

In the case of the muscle tensor fasciae latae the procedure was performed by the assistance of the impact of gravity instead of providence of counter pressure (gravity-induced PIR).

5. Strengthening exercises for the associated group of muscles of the lower extremities

The strengthening exercises that were performed were the same and were aiming into the same muscle groups as in the previous session. Namely the muscle groups that were strengthened were:

1. Adductor group of muscles of the lower extremity in the area of the hip joint
2. Gluteus Medius and Minimus muscles
3. Tibialis posterior muscle
4. Gastrocnemius and Soleus muscle (Triceps Surrae m.)

5. Deep muscles of the abdominal and pelvic area

The following strengthening exercises were performed either by the use of therra-band elastic band (Adductor group of muscles, Tibialis Posterior and Triceps Surrae m.) or with the patient being in standing position supported by the wooden supports of the room where the therapy took place and performing the associated movements of the lower extremities (Gluteus Medius & Minimus muscles). For the deep muscles of the abdominal and pelvic area an over-ball equipment was used.

6. Exercises for the improvement of the balance of the patient according to the principles of V. Janda

The particular exercises were performed while the patient was in supine position. The principles that I followed were the same one that were performed during the previous session with the patient. An over-ball was placed between the flexed lower extremities at the height of the knee joints. The patient is elevating the area of the pelvis retaining her stability and trying to move the A.S.I.S into lateral directions. Before the elevation of the body of the patient providence of pressure in different directions can be applied while the patient is keeping her initial position.

7. Exercises for the increase of the sensory perception of the lower extremities of the patient according to V. Janda

The exercise aiming into the increase of the sensory perception of the lower extremities was performed manually or by the use of a small specially designed elastic ball that was carrying nails in it's circumference.
The way that the exercise was performed was the similar as in the previous session and the aim was to irritate the three points located on the plantar surface of the sole of the foot that present the maximal sensory input (heel and the lateral aspects of the first and fifth metatarsal)

8. Correction of the standing position of the patient in stable surface

The correction of the standing position was performed in the stable surface of the floor of the room where the session took place. The principles of the exercise for the correction of the standing position were the same as in the previous day/session that we performed with the patient. The comments that I gave to my patient were:

- The feet should be parallel to each other and hip-width apart – the toes are pointed forward
- The patient leans a little bit forward so that the weight is transferred over the ankle joint – the aim of that stage is to obtain an alignment between the lower extremities, the pelvis, the trunk and the head
- Then the patient should flex a little bit (approximately 20^0) the lower extremities in the area of the knee joint and perform a slight external/lateral rotation at the area of the hip joint. During that step the foot's position hasn't changed.
- The patient should try to control the area of the pelvis and abdomen – and perform elongation of the spinal cord
- Controlling of the shoulders and relaxation of the upper extremities

- Finally a correction of the position of the head is performed. The manual contact is with one hand on the chin of the patient and the other one on the site of the occipital bone.

After the end of the adaptation to that new position I asked my patient to remain for a little bit to that position.

Teaching exercises for self-therapy

The exercises that I asked the patient to perform were the same as the last time:

- The exercises concerning the small foot
- The ankle pumps
- The strengthening of the associated muscle groups in a standing position using support

The only exercise that the patient performed the previous time by herself was the one concerning the elongation of the small foot. I was happy that at least she tried this one as it will increase the proprioception. Maybe the strengthening in standing position is a little bit more demanding for her so I asked her at least perform the ankle pumps and the small foot during the day.

Results (Objective and Subjective) of the second session

The second day of the therapy program continued in the same motive as the previous one. The present state of the patient doesn't have some major cases with the one session before. The performance of the therapeutic exercises went smoothly with the patient capable to perform all the exercises and with no signs of pain or some other kind of pathological signs.

The mobilization of the patella was also performed during the particular therapy session. It is very soon to make some major conclusions but I believed that the mobility was slightly better than before and till the end of the therapy program the condition will be so much better.

The strengthening and the stretching exercises are continuing.

Sensory-motor stimulation according to the principles of K. Lewit was applied before the correction of the posture of the patient in standing position. The exercise was done in stable surface and again the adaptation of the patient in the corrected position as well the balance of her was in a very satisfactory level.

3.6.3 Third Session - Friday 20th of January 2012

That was the last session for the current week of the applied therapy program.

According to the previous session the conclusions that I made are:

- The stability of the patient is pretty good already, and it presents gradual improvement after each session.
- Relaxation is achieved concerning the muscle groups that during the initial kinesiology examination presented increased tonicity
- The strength of the associated muscles of the lower extremities as well of those of the deep area of the abdominals and pelvic area has been retained into

satisfactory levels being enough to support the daily living activities of the patient.

- The patient has adapted to the correction of the posture that I indicated to her. The results can be seen from the fact that the deviation of her body to the left direction presents a slight decrease.

Control Examination

Before the application of the therapeutic procedures a brief control examination was conducted in order to evaluate the progress of the patient in comparison with the previous sessions.

The control examination included:

- Examination of the joint play of the knee joint of both lower extremities according to the principles of K. Lewit
- Examination of the post-surgical incision and of the associated lower extremity according to the principles of K. Lewit
- Muscle Length Testing according to H.O. Kendall and grading of V. Janda
- Muscle Strength Testing according to H.O. Kendall
- Examination of the stability of the patient according to V. Janda

1. Examination of the joint play of the knee joint of both lower extremities according to the principles of K. Lewit

For the associated control examination the patient was in supine position on the examination bed with the upper and lower extremities being relaxed along the trunk of hers and the low back area being in contact with the examination bed. The movement directions that were examined included: medial one, lateral one, cranial and caudal. As an outcome of the examination the patella of the left lower extremity is still in a very good condition. The right one after the two session-applications of mobilization begins to show satisfactory result improving the mobility in the previously restricted directions.

2. Muscle Length testing according to H.O. Kendall

The results of the control examination concerning the length of the associated group of muscles of the lower extremities were very satisfactory. The shortness in the group of Hamstrings has decreased significantly. The shortness of the Tensor Fasciae Latae muscle presents also decrease but not as much as the Hamstrings. So in the current session I will concentrate more on the particular muscle instead of stretching more the hamstrings group of muscles since they are presenting such a good condition.

3. Muscle Strength Testing according to H.O. Kendall

The strength of the muscles of the lower extremities is in a very good condition. The muscles are able to provide counter-pressure against the application of moderate pressure, which renders them able to support the activities of the patient

4. Examination of the stability of the patient according to V. Janda

Until now the improvement of the stability and the co-ordination of the patient are tremendous. The particular control examination didn’t have any different result. The

patient is able to retain her stability in all the examined positions: sitting and standing position whether she is performing the particular examination on stable or unstable surface.

Goals of today's therapy unit

The today's therapy unit was containing exercises such as:

- Mobilization of the knee joint in all the possible directions according to the principles of K. Lewit
- Stretching exercises aiming exclusively to the Tensor Fasciae Latae
- Strengthening exercises for the associated group of muscles of the lower extremities
- Exercises for the increase of the sensory perception of the plantar surface of the foot
- Correction of the posture of the patient in stable and unstable surfaces
- Exercises for the improvement of the co-ordination of the patient in stable and unstable surfaces

1. Mobilization of the knee joint in all the possible directions according to the principles of K. Lewit

The today's therapeutic program started once again with the performance of the mobilization of the patella on both lower extremities. The principles of the procedure, including the positions of the patient and therapist were the same. Mobilization was performed in all possible directions such as medial, lateral, caudal and cranial direction.

2. Stretching exercises aiming exclusive to the Tensor Fasciae Latae m.

Since the hamstring group of muscles presented a big difference concerning the length – always compared with the previous sessions, I decided to concentrate on the other muscle that presented shortness during the initial kinesiology examination which was the tensor fascia latae.

The stretching exercises that were performed were the same as in the previously performed sessions:

1. Stretching of tensor fasciae latae with the patient being in standing position
2. Stretching of tensor fasciae latae with the patient being in side-lying position

3. Strengthening exercises for the associated group of muscles of the lower extremities

The strengthening exercises were performed in similar way as in the previous sessions for the following muscles of the lower extremities:

- Adductor group of muscles – in supine-lying position on the examination bed
- Gluteus Medius and Minimus – in supine-lying and standing position supported by the wooden bars
- Tibialis Posterior - in supine position on the examination bed

- Triceps Surrae muscle - in supine position on the examination bed

For the performance of the associated exercises the following equipment was used:

- A therra-band elastic band of yellow color and mild-resistance
- An over-ball
- The wooden bars of the room where the session was performed.

4. Exercises for the increase of the sensory perception of the plantar surface of the foot

The methods for the improvement/increase of the sensory perception of the plantar surfaces of the lower extremities were done in the same way like in the previous sessions. First performed manually on the plantar surface of the sole of the foot and then by the use of a small ball that carries nails on it's periphery. The exercise was intentionally performed before the execution of the correction of the posture of the patient in standing position and the exercises for the improvement of the co-ordination of the patient in stable surface.

5. Correction of the posture of the patient in stable and unstable surfaces

The exercises for the correction of the posture of the patient followed the same principles and comments as in the previous sessions that I had with the patient

Namely the comments that I gave to the patient were:

- The feet should be parallel to each other and hip-width apart – the toes are pointed forward
- The patient leans a little bit forward so that the weight is transferred over the ankle joint – the aim of that stage is to obtain an alignment between the lower extremities, the pelvis, the trunk and the head
- Then the patient should flex a little bit (approximately 20^0) the lower extremities in the area of the knee joint and perform a slight external/lateral rotation at the area of the hip joint. During that step the foot's position hasn't changed.
- The patient should try to control the area of the pelvis and abdomen – and perform elongation of the spinal cord
- Controlling of the shoulders and relaxation of the upper extremities
- Finally a correction of the position of the head is performed. The manual contact is with one hand on the chin of the patient and the other one on the site of the occipital bone.

At the beginning of the session the correction of the posture was performed in a stable surface. Then I wanted to try the particular exercise in an unstable surface, since the stability of the patient was very good. For that reason I tried the bosu equipment.

The bosu equipment was preferred for two reasons:

- It provided the unstable surface that I wanted to test the patient on and
- At the same times it was a not so small surface that the patient could balance. I believe that in the case that I would use a rocker board the patient would face a bigger difficulty to retain her stability and perform the correction of the posture.

The patient at the beginning wanted some minutes in order to find her position and stabilize. After that we began proceeding into the main part of the exercise. I told the patient the associated comments and she followed them correcting her posture.

During the exercise the only body segment that she had some difficulty controlling was the head. She had the tendency to put the head up in order to look forward. So there was the need of correcting that position. Other than that the execution of the exercise was very satisfactory.

6. Exercises for the improvement of the co-ordination of the patient in stable and unstable surfaces

The particular session ended with the exercises for the improvement of the co-ordination of the patient. That was the first time that the particular exercise was performed. I thought that since the stability of the patient was presenting a gradual improvement such an exercise would assist into the further improvement of the balance and the patient would like it.
For the transaction of the exercise an over-ball was used.
The patient was in standing position on a stable surface after adapting the corrections of the previous exercise. In that state I was throwing the ball to the patient and I asked her to throw it back at me. During the exercise I asked her to perform any kind of movement with the upper extremities she wanted while holding the over-ball. The patient was able to do it and she didn't have any kind of problem.

In sequence we performed that exercise while the patient was in standing position on the bosu equipment. I gave her firstly the time she needed in order to find her balance and then we started the exercise in the same way as while she was standing in a stable surface.
During the performance of the exercise with the throwing of the over-ball I asked also from my supervisor to take part in order the patient to have bigger range of throwing

Results (objectives and subjective) of the third session

The first week of the therapy sessions ended with the patient being in a very good condition regarding her state of muscles tonicity, strength and the stability. The joint play that is present on both knee joints is presenting results after the one week of application of the mobilization. The stability of the patient as was described at the beginning of the control examination has shown a gradual improvement. For the following week which will be also the last of the therapy program I would like to concentrate more on the improvement of the balance/stability of the patient by performing a little bit more difficult exercises.

3.6.4 Fourth Session - Monday 23rd of January 2012

Present state
On Monday the 23rd took place the fourth session I had with the patient. During the previous week the therapeutic program that was performed was aiming in the

improvement of the range of motion, the strengthening of the associated muscles, the relaxation of those that were presenting increased tonicity and the correction of the posture. Still the balance of the patient is pretty good but the complaints for the area of the knee joint haven't stopped. The patient at the time doesn't feel any kind of pain or any other unpleasant feeling. So during the second and last week of the practice I wanted to concentrate in exercises for the improvement of the balance of the patient in several surfaces like the stable that is on the place where the sessions take place, or some bosu/rocker board equipment. For that reason an important part of the sessions took place in the gym-room that the department of rehabilitation had where there were a lot of relative equipment. The exercises that I ask the patient to perform during this week were a little bit more difficult than those of the previous week. Always the equipment that I used and the exercises that were performed were done with respect to the abilities and condition of the patient.

Control examination

Before accessing in the day's therapeutic unit a brief control examination took place. That examination performed in order to check the patient's current state after a week of therapy and compare it with the previous state. The control examination would show us if there was some improvement or not and included:

1. Examination of the mobility of the post-surgical incision and of the area of the skin around it

The post-surgical incision doesn't present any kind of restriction in the directions that were tested. There are no pathological conditions such as hematomaes, secretion e.t.c. Also the skin of the thigh around the area where the incision is located doesn't present any kind of difference concerning the temperature and color. Those statements were done after comparing the associated area with the rest of the operated lower extremity of the patient.

2. Palpation of the muscle groups of the lower extremities in order to evaluate their tonicity

The tonicity of the muscles has been improved. The muscles that were presenting increased tonicity after the application of P.I.R have been more relaxed. As for the muscles that presented decreased tonicity the state has been improved through the performance of the several exercises.

3. Examination of the mobility of the patella in all the possible directions (medially, laterally, caudally and cranially)

The mobility of the patella on both lower extremities is pretty much the same. The patella on the left lower extremity [the operated one] presents a very good mobility in all the directions. On the other hand the patella on the right lower extremity presents improvement considering the previous state of it presenting restriction during the performance of movements in all directions but mostly on the lateral direction.

4 Length testing of the muscle groups of the lower extremities according to the principles of H.O. Kendall and the grading of V. Janda

During the performance of the initial kinesiology examination the results concerning the evaluation of the length of the muscle groups were that the muscles Tensor Fasciae Latae and the Hamstring group of muscles presented shortness. During the first week of the therapeutic procedure, I applied stretching exercises concentrating on those particular muscles. The results of the control examination showed positive results as the shortness of the hamstring group of muscles was reduced significantly and the tensor fasciae latae presented also some exemplary decrease of shortness

5. Strength testing of the muscle groups of the lower extremities according to the principles of H.O. Kendall

The results of the initial kinesiology examination that took place the previous week showed that the muscle groups of the lower extremities have enough muscle power in order to support the associated joints and the daily living activities of the patient. Exercises for the strengthening of those particular muscles were performed during the last week of session. The examination took place again in the beginning of the second week to estimate the state of the muscle power on that given time

6. Examination of the stability of the patient in sitting and standing position according to the principles of V. Janda

The examination of the patient is pretty good and shows a great improvement compared with the first sessions we had. The control examination of the patient concerning the stability was performed in supine, sitting and standing position. The results were very good, but still there is the need for more exercises in order also the patient to feel more confident and secure concerning her own stability. Also during the current week there should be applied some exercises concerning the prevention of falling.

Goals of today's therapy unit

1. Mobilization of the patella of the lower extremities (bilaterally) following the principles of K. Lewit – Joint Play
2. Performance of P.N.F. technique according to H. Kabat (first diagonal of flexion of the lower extremities)
3. Strengthening exercises for the associated muscle groups of the lower extremities
4. Exercises for the improvement of the stability of the patient
5. Stimulation of the plantar surface of the sole of the patient's lower extremities according to V. Janda
6. Correction of the posture in standing position according to the principles of V. Janda in a stable surface
7. Exercises performed on the bosu equipment
8. Correction of the posture in standing position according to the principles of V. Janda on the bosu equipment

1. Mobilization of the patella of the lower extremities (bilaterally) following the principles of K. Lewit – Joint Play

The mobilization of the patella in both lower extremities was performed following the same principles as in the previous sessions that I had with the patient. The starting position of the patient was the same – supine on the examination bed and the mobilization was performed in the directions: medial, lateral, cranial and caudal.

2. Performance of P.N.F technique according to H. Kabat (first diagonal of flexion of the lower extremities)

The patient is in a post-surgical state of three months. That makes her able to perform the diagonal movements of P.N.F. without the danger of any possible dislocation. For the performance of the diagonals the patient was in supine position at first. That was the first time that the patient was asked to perform P.N.F during her rehabilitation. For that reason at the beginning I performed the procedure assistive so that the patient could understand what and how the procedure is. Then the patient turned in side-lying position in order to perform again the diagonal of first flexion of the lower extremities The second diagonal of flexion on the lower extremities was avoided to be performed, even the patient is in a post-surgical state of the surgery because of it's movement component of hip adduction.

3. Strengthening exercises for the associated muscle groups of the lower extremities

The strengthening exercises were provided for the following muscles:

- Gluteus Medius and Gluteus Medius
- Adductor group of muscles and
- Deep muscles of the abdominal-pelvic area

I wanted to perform the strengthening exercises after the performance of the P.N.F. since it would improve the proprioception and the condition of the strength of the muscles. I asked my patient to start with the exercises that requires her to be in supine position and then to proceed to the ones that were in standing so from that position we would continue with the other exercises associated with the balance and the posture

4. Exercises for the improvement of the stability of the patient

Exercise no. 1

The patient is on the examination bed in supine position. The upper extremities are placed relaxed on the examination bed along the trunk of the patient. The lower extremities are flexed in the area of the knee joint. The area of the low back is in contact with the bed.

An over-ball is placed between the flexed lower extremities of the patient in the height of the knees. From that position the patient performs a small elevation of the pelvis and

the trunk and remain in that elevated position. The elevation is about 10-20cm. At that state the patient should try provide pressure and control the abdominal and pelvic area and the associated muscle groups. The patient tries to move the two iliac bones into lateral directions. The patient stays in that position for about 10s, then relaxes and elevates again the pelvis.

Exercise no. 2

The patient is on the examination bed in supine position. The lower extremities could be placed straight on the surface of the examination bed or flexed in the knee joint area. The upper extremities are presenting:

- Flexion in the area of the shoulder joint
- Flexion in the area of the elbow joint
- The forearms were in neutral position between supination and pronation

Pressure is provided on the upper extremities of the patient towards different directions. The patient tries to provide counter-pressure to the movement but with having the associated extremity fixed in the starting position.

Exercise no. 3

The patient is on the examination bed, in sitting position on the edge of the examination bed. The lower extremities of the patient are hanging down but they have a good contact with the surface.

The exercises that we applied in that case were according to the principles of V. Janda concerning the sensory-motor stimulation. We explained the patient that I would provide pressure in different parts of the body of hers and she should stay still, keeping her initial position. She shouldn't provide resistance in an opposite direction of my applied force, but instead just resist any alternation to the starting movement. That techniques were applied in the area of the upper trunk of the patient and then on the lower extremities in the area of the calves of the patient.

5. Stimulation of the plantar surface of the sole of the patient's lower extremities according to the principles of V. Janda

The patient is on the examination bed in prone position. The upper extremities are placed on the surface of the examination bed relaxed along the trunk of the patient. The lower extremities are slightly flexed in the area of the knee joint and they can be supported by an associated plastic mattress/cushion. The plastic mattress is placed on the height of the calves' segment of the lower extremities so that the heels would be a little bit elevated.

The procedure includes manually performance of circulatory movements along the whole plantar surface of the foot of the patient. The performance is aiming into the irritation the three points of maximal sensation which are the heel and the lateral aspects of the first and the fifth metatarsal. After the performance of the manual irritation of the

plantar surface I tried the same technique and method by using a specially designed ball with nails under the name “Jezyk”. The application was performed on both lower extremities’ sole area.

6. Correction of posture in standing position according to the principles of V. Janda

The patient is in standing position. The correction of the posture in standing position was performed after the stimulation of the plantar surface of the foot. No dizziness or some other unpleasant feeling was recorded by the patient – the only positive comment was regarding the sensation of the lower extremities

The instructions that were given to the patient with aiming the correction of the posture are:

- The feet of the patient should be parallel, hip-width apart and toes pointed forward
- The patient flexes slightly the lower extremities [approximately 20^0] in the area of the knee joint and leans her body forward so that the weight is transferred to the forefoot region. The heels should remain fixed on the floor and the rest of the body [upper trunk, upper extremities, pelvis and lower extremities] is in an alignment.
- External rotation of the hip joints
- Control of the pelvic and abdominal region and muscles
- Relaxation of the upper trunk and shoulder girdle area
- Correction of the head to look forward, of the back and chest area so that the trunk of the patient is straight.

7. Exercises performed on the bosu equipment

That was the first time that during a therapy session with the patient, the bosu equipment was used. During the first week of therapy there was some correction of the posture in the bosu equipment but now was the first time of performance of exercises. The exercises that were performed on the bosu equipment included:

Performance of walking-like movement
That was the first exercise that was performed on the bosu equipment. The patient was in standing position using her upper extremities in order to support the rest of the body of hers and from that position she was performing flexion and extension of the lower extremities reproducing the movements that are performed during walking.

Strengthening exercises of the associated muscle groups of the hip joint
The patient while being in standing position on the bosu equipment performed some of the strengthening exercises that were done before while she was on a stable surface. Those exercises were:

1. Strengthening of the Gluteus Medius and Minimus muscles
2. Strengthening of the adductor group of muscles

8. Correction of the standing position of the patient
That was the last exercise performed on the bosu equipment. The patient was in standing position and then the steps that are followed during the same exercise in stable surface were performed.

Results (objective and subjective) of the fourth session

The stability of the patient and her ability to correct the posture of her in stable but also in unstable surfaces is tremendous. The patient isn't experiencing any kind of problems with the exercises and as she sais the condition of the knee joints starts to improve. One week before the patient was complaining about a feeling of instability in the area of the knee joints but now that feeling has been retreated which is a very positive fact for the continue of the therapy.

3.6.5 Fifth Session - Wednesday 25th of January 2012

Present State
That was the fifth session I had with the patient. The patient doesn't feel any kind of pain during the performance of the therapeutic techniques but also during the rest of the day considering the performance of the daily living activities of her. She is still using the crutches in order to walk. The patient feels better considering the state of her knee joint. At the beginning the main complaint of her was that she was feeling unstable the area of the knee joint of both lower extremities, but especially the left one during the performance of walking. Now as she says that feeling begins to retreat and she feels more confident than before. Other than that no other complaint is recorded such as dizziness or any other unpleasant feeling.

Control examination
Before the beginning of the therapy a brief examination was performed in order to see if there was any change in the state of the patient compared with the previous session we had. That examination included:

1. Examination of the mobility of the post-surgical incision and of the area of the skin around the incision

The mobility of the post-surgical incision was very good. The incision up to the date of that evaluation didn't present any kind of pathological sign such as secretion or change of color e.t.c. In the same condition was also the area around the post-surgical incision. It was characterized by the same temperature and color with the rest of the body segment. The post-surgical incision didn't present a state that something more to be performed from the therapeutically point of view is necessary.

2. Examination of the mobility of the patella of both lower extremities

The left patella still presents a very good mobility in all the possible directions. The right patella presents an improvement in the mobility especially in the medial and lateral directions which were restricted, but still the mobility is not good enough in comparison

with the left lower extremity. Mobilization techniques should be performed for the patella of the right lower extremity during the particular session

3. Examination of the strength of the abductors, adductors and calf muscles

No further strengthening exercises should be performed. The associated muscles are in a good condition being able to support the patient in the performance of the several activities of hers.

Goals of today's therapy unit

At that point the patient has achieved a very good balance. The posture in standing position has been corrected and the patient tries to adopt those corrections. In today's therapeutically unit I want to perform exercises that will aim in the improvement of the stability of the patient but with larger base, maybe in one leg position if possible, and in a less stable surface.

1. Stimulation of the plantar surfaces of the lower extremities of the patient (performed manually and with the use of special balls)
2. Mobilization of the patella in all possible directions (medially, laterally, caudally and cranially)
3. Correction of the posture in standing position – at the beginning with two lower extremities base and then if it is possible go to one leg stance position
4. Prevention of falling/ performance of lunges according to the principles of V. Janda
5. Improvement of the balance of the patient in the final position of the previous examination – after the lunges have been performed
6. Application of sensory motor stimulation and trying again the correction of the posture in an unstable surface
7. Improvement of the co-ordination of the patient according to V. Janda
8. Teaching exercises for self-therapy (mainly exercises that have to do with the improvement of the sensation of the lower extremities)

1. Stimulation of the plantar surfaces of the lower extremities of the patient (performed manually and with the use of special balls) according to V. Janda

The session started with the stimulation of both plantar surfaces of both lower extremities of the patient. For that procedure the patient was on the examination bed in prone position. The stimulation of the plantar surface of the foot was done firstly manually and then with the use of a specially designed small ball that has nails. The procedure followed the same principles that were applied during the previous sessions.

2. Mobilization of the patella in all the possible directions (medially-laterally-caudally – cranially) according to K. Lewit

The mobilization of the patella was performed in medial, lateral, caudal and cranial direction. No pain was recorded during the performance of the mobilization. There is significant difference between the mobility that was present during the first session and

the current one. Of course the up-to-date mobility of the left patella is in better condition than the right one without that stating that there is no improvement in the right one.

3. Correction of the posture

3. a Correction of the posture in stable surface

The patient was in standing position without the crutches. The position of hers was the anatomical position with the upper extremities being hanging down along the trunk of the patient and the heels of the patient been in a hip-width apart position.

While the patient was in standing position the following instructions were given to follow:

- The feet should have as much as possible full contact with the surface of the examination room. The patient should try to have in contact especially the three points of maximal sensory perception: the heel, the lateral parts of the first and the fifth metatarsal.
- The feet of the patient should be parallel, hip-width apart and toes pointed forward
- The patient flexes slightly the lower extremities [approximately 20^0] in the area of the knee joint and leans her body forward so that the weight is transferred to the forefoot region. The heels should remain fixed on the floor and the rest of the body [upper trunk, upper extremities, pelvis and lower extremities] is in an alignment.
- External rotation of the hip joints
- Control of the pelvic and abdominal region and muscles
- Relaxation of the upper trunk and shoulder girdle area
- Correction of the head to look forward, of the back and chest area so that the trunk of the patient is straight. Correction of the position of the chin

In that position the patient informed me that she wasn't feeling any kind of dizziness. Since the patient obtained stability in that position I tried to provide some pressure in several directions to see the balance of the patient.

3. b Correction of posture in standing position using an unstable surface

The patient at the beginning of the exercise was in standing position on the bosu equipment. Before the beginning of the exercise and for gaining stability the patient was using the upper extremities of her to grab into some supporters that were on the room where the examination took place

We followed the usual pattern of the exercise, providing the instructions to the patient. The patient was still using her upper extremities in order to gain balance in the bosu. We gave the patient the associated instructions as before. As the patient was very good in keeping the balance while she was on the bosu I asked her if she could let her upper extremities and not being supported by them. The patient at the beginning felt a little bit

unstable, but then she was ok. I didn't try the same exercise with closed eyes since the patient has a small difficulty without the support of the upper extremities

4. Prevention of falling/performance of Lunges according to V. Janda

That was the first time that I tried an exercise like that with the patient. For the performance of that exercise we were transferred to the specially equipped gym room that the department of rehabilitation had. The goal of that exercise is to accelerate the reaction of the patient in such condition when the balance is lost. Thus training such conditions we prevent any possible injuries in the lower extremities, in the joints and the spinal column. During the performance of the lunges the patient wasn't using her crutches.

At the beginning the patient was in standing position having the corrected posture from the previous exercise.

The patient started to lean forward so that the center of gravity shifts forward. When the balance seemed to be lost, the patient stepped with one lower extremity placed forward. The reaction of the patient was quick. Although the landing of the foot wasn't so soft and springy. Then I corrected a little bit the posture of the patient in that position and we tried again a couple of times the performance of lunges. After a couple of lunges the reaction of the patient was improved. The foot started to land with a softer impart on the lower extremity. The patient seemed to understand the mechanism and the way of the performance of the exercise. No pain or some other complaint was recorded during the performance of that exercise.

The final position of the lunges found the patient in a position that presented:

- Flexion of the forward lower extremity in the area of the knee joint [approximately 90^0]
- Forming of a small foot [of the forward lower extremity]
- The back lower extremity was supported on the tip toe.

5. Improvement of the balance of the patient in the final position of the previous examination (after the lunges have been performed)

The starting position of the patient should be the final position of the previous exercise [lunges]. That position should present:

- A general leaning of the body of the patient forward, in that way so the center of gravity/weight will be shifted towards the forefoot.
- The one lower extremity should be placed forward in comparison with the rest of the body
- The forward-placed lower extremity should present a flexion in the area of the knee joint approximately 90^0
- The forward-placed lower extremity present the formation of a small foot
- The back lower extremity is supported on the tip of the foot.

In that position we provide pressure on the body of the patient in different directions. The patient should remain straight, keeping the starting position of hers no matter what.

That exercise is the same that we were doing while the patient was in standing and sitting position. The only difference is that now the posture of the patient is different. The pressure was applied on the area of the upper trunk of the patient and on the lower extremities.

6. Application of sensory motor stimulation and trying again the correction of the posture in an unstable surface

The patient was in sitting position on the examination bed near the edge of it. The lower extremities were presenting flexion in the area of the knee joint and were hanging down from the edge of the examination bed.

Exercise no. 1

I was in sitting position in that way so the lower extremity of the patient was placed on my thigh area. From that point succeeding the anti-gravity position of the particular body segment of the patient I applied methods for stimulating the plantar surface of the sole of the foot. Those methods included:

- Manually performed massage on the plantar surface of the foot
- Massage performed by the use of specially designed ball with nails.

The performance included both lower extremities.

Exercise no. 2

After the complete of the previous exercise I asked the patient to move a little bit forward so that her lower extremities would reach the floor (the foot area of them). At that point I performed the exercises concerning the small foot area:

- Firstly passive elongation of the small foot area of the patient
- Then active elongation of the small foot area of the patient

After the end of the application of the sensory motor stimulation I asked the patient to try again the exercise concerning the correction of the posture, but now on an unstable surface. The adaptation to the correct posture it was easier for the patient after the performance of the sensory-motor stimulation. After that I asked her to try again, if she was feeling ok to close the eyes first and then free the upper extremities in a try to perform the previously un-successful exercise. The results were better this time but still the stability of the patient while she is with closed eyes isn't good enough. Apart from that I was very satisfied with her ability to balance in both stable and unstable surfaces.

7. Improvement of the co-ordination of the patient according to V. Janda

While the patient was in standing position on either stable on unstable surface I tried some co-ordination exercises according to the sensory-motor stimulation of V. Janda

For that particular exercise I used over-ball equipment.

The patient was in standing position and we were exchanging the ball by throwing one to another. The reflexes and the co-ordination of the patient was very good whether she was on the stable surface of the floor of the room or on the unstable surface of the bosu equipment.

There was no complaint during the performance of the particular exercise by the patient, more that she enjoyed it.

8. Teaching exercises for self-therapy (mainly exercise that have to do with the improvement of the sensation of the lower extremities)

Since our therapy program with the patient was coming to an end I was more concerned about teaching her some exercises that she could perform by her own on her house and would contribute to the improvement of the stability of her than the strengthening of the muscle groups which were presenting already enough muscle power to support the different activities of the patient. In summary the exercises that were asked by the patient to perform by her own were:

- The shortening exercises of the small foot
- Use of the small balls with the nails in order to increase the proprioception of the plantar surface of the sole of the lower extremities. The particular exercise is quite simple to perform and will have great results in the continue

Results (objective and subjective) of the fifth session

In the particular session the control examination presents a very good state regarding the strength of the muscles. Also after a couple of performed therapy session I performed again the examination to evaluate the condition of the post-surgical incision – in case there was some difference between the current state and the initial one. Concerning the stability of the patient we continued with the exercises in both stable and unstable exercises, including the correction of the posture and the co-ordination. The results on the prevention of falling exercises were very positive. A couple of self-therapy exercises were indicated for the patient for the improvement of the sensation

3.6.6 Sixth Session - Friday 27th of January 2012 [Last session with the patient]

Present State

That was the last session I had with the patient during my practice. In the previous session we had, we tried for the first time the performance of lunges in an effort to prevent any possible falling in the near future. The current state of the patient presents many differences in comparison with the initial state. There is no pain concerning the operated lower extremity, or even the non-operated. The patient has improved her posture, now she is feeling more confident during her walking regarding the area of the knee joint. The stability has a great improvement considering the fact that the patient is able to retain her stability even when she is on unstable surfaces such as the bosu or the rocker board. All those statement are providing a very good disposition for the future rehabilitation and the prognosis of the patient.

Control Examination

Since that was the last session with the patient, a final kinesiology examination was performed in order to evaluate the differences between the current state of the patient and the initial one. The final kinesiology examination included all the examinations that were performed in the initial one and it was performed after the end of application of the therapeutic procedure in order to have completed at least six session of the therapy procedures and then see the state of the patient.

Goals of today's therapy unit

The main thing that I wanted to exercise again is the ability of the patient to perform the lunges in order to prevent the falling and any further damage resulting from it. We provided that exercise only once during the sessions we had with the patient, so it would be good if there was some repetition of that exercise. Except from that I didn't want to make the patient tired since that was the last session, taking in consideration that there wasn't enough time because I had to perform also the final kinesiology examination summing up the therapy program.

The goals of today's therapy unit:

1. Exercises for the increase of the sensation of the lower extremities [performed manually or with the use of special equipment – small ball with nails]
2. Application of P.N.F. techniques for the lower extremities according to the principles of H. Kabat
3. Correction of the posture in standing position with stable and unstable surface (use of rocker board, bossu)
4. Performance of lunges – prevention of falling
5. Testing the balance of the patient in the final position after the performance of the lunges.

1. Exercises for the increase of the sensation of the lower extremities (performed manually or with the use of special equipment – small ball with nails)

The exercises were performed while the patient was in supine position on the examination bed. The procedure was pretty similar as in the previous sessions that I had with the patient. For the increase of the sensation firstly I performed manually massage on both plantar surfaces of the lower extremities of the patient –including the three points of maximal proprioception and I continue with the performance of a massage in the plantar aspect of the sole of the lower extremity with the use of a special ball with nails.

2. Application of P.N.F. techniques for the lower extremities according to the principles of H. Kabat

The diagonal that was performed was the first diagonal in the pattern of flexion and extension for the lower extremities. The patient was in supine-lying position on the examination bed as in the previous times that we performed that particular exercise.

During the first couple of times that we performed the P.N.F. technique my manual contacts and the whole procedure was done in the assistive type of way. That was done not because of any kind of muscle weakness of the associated muscles of the lower extremities but because the patient wasn't familiar with the technique. During that session the P.N.F. technique was performed passively but there was also an attempt to do it actively. The patient was eager and she tried her best to perform the pattern and the movement components.

3. Correction of the posture in standing position with stable and unstable surface (use of rocker board, bosu)

The particular exercise was performed in the same way like on the previously done sessions under the same comments:

- A general leaning of the body of the patient forward, in that way so the center of gravity/weight will be shifted towards the forefoot.
- The one lower extremity should be placed forward in comparison with the rest of the body
- The forward-placed lower extremity should present a flexion in the area of the knee joint approximately 90^0
- The forward-placed lower extremity present the formation of a small foot
- The back lower extremity is supported on the tip of the foot.

After the performance of the particular exercise in a stable surface we proceeded to the less-stable ones. That included stabilizing on the bosu and the rocker boards. In all the surfaces that we tried the exercise the stability of the patient was very good and indicated a big improvement in comparison with the first sessions. The only small modification that I tried while the patient was on the bosu was to ask her to close her eyes and try as much as possible to retain her stability.

The patient at the first moment that closed her eyes, felt a little bit unstable and she needed to hold with her hands the wooden bars of the room where the session took place. After that she tried again and she managed to have stability in that position. While the patient was in standing position on the bosu I tried to apply pressure towards different directions in order to test the stability. The results were very satisfactory.

4. Performance of lunges – prevention of falling

The particular exercise was performed in the same way as in the previous session we had.

The patient was in standing position and in sequence she was leaning forward so that the center of gravity would be shifted and just before she would lose balance and fall, she uses the other lower extremity to retain the standing position

At the beginning the patient was performing the exercise correct but there was greater impact on the lower extremities while she was landing. I asked her to perform again the exercise but try to concentrate and don't provide so much pressure on the lower extremities – the landing should be more smooth. The patient seemed to have understood the exercise since she performed it correctly after a couple of tries.

5. Testing the balance of the patient in the final position after the performance of the lunges

The exercise was following the principles of V. Janda for testing the stability of the patient. The procedure was the same as when I applied pressure to the patient in different directions and she was in sitting or standing position. The only difference now was that the position of the patient was different-being at the end of the performance of the lunges

3.7 Final Kinesiology Examination

The final kinesiology examination took place after the end of the performance of the six sessions in order to sum up and evaluate the progress that the patient presented after the attendance of the therapeutic program.
During the particular evaluation there were notable differences between the present state and the initial one of the patient

The thing that was more delight with was that in the question if the patient had some complaint about the program we followed and our work the answer was negative. She was very satisfied as she said and there wasn't any kind of problem

3.7.1 Postural examination of the patient – ventral, lateral and dorsal view – Final Kinesiology Examination

The examination of the posture of the patient as well all of the examinations that were part of the final kinesiology examination were performed under the same principles that were followed in the initial evaluation

Anterior/Ventral View

Distance between the feet	The feet of the patient were close to each other.
Ankle joint	**The swelling of the right ankle was decreased (improved)**
Contour of the calves	The calves weren't symmetrical
Knee joint	Both knee joints were presenting deviation. The left knee joint was presenting a scar on the medial surface of it and the right one was placed higher in comparison with the left. The alignment that presents the lower extremities of the patient is that of valgosity.
Thighs	The thighs are not symmetrical
Lower abdomen area	The abdomen area is presenting a slight protraction. The navel is deviated to the

	right of the body. The navel is on the surface of the abdomen and not in some depth. The lateral contour of the abdominal walls present concave alignment
Anterior Superior Iliac Spine (A.S.I.S.)	**The difference between the left and the right anterior superior iliac spine was decreased (improved)**
Axillary triangle	The right Axillary triangle is bigger than the left one
Sternum and pectoral muscles area	The chest area presents symmetry as well good mobility when it comes to the expansion of the thoracic cage during inspiration and the mobility of the ribs. There wasn't any kind of deformity of the associated area [e.g. Barell chest, PectusExcavatum, PectusCarinatum].
Clavicle and shoulder girdle area	The right clavicle seems to be slightly higher in comparison with the left one. The right shoulder seemed to be a little bit higher in comparison with the left one, but again the difference was slight.
Head	The head of the patient is slightly deviated to the right in comparison with the rest of the body.

Table no. 19 - Examination by observation of the anterior aspect of the body of the patient – Final Kinesiology Examination.

Lateral View

The shape of the calves	Both calf areas of the lower extremities of the patient were presenting symmetry from the lateral view of observation
The area of the knee joint	**The hyper-extension of both lower extremities was presenting improvement**
Buttocks area [tonicity of the glutei muscles]	**The tonicity of the gluteal muscles was improved (improved)**
The abdominal muscles area	**The protraction of the abdominal muscles have been slightly decreased (improved)**
The lumbar part of the spinal cord	**The lordosis of the lumbar aspect of the spinal cord was slightly decreased (improved)**. The flatness that was characterizing the near-buttock area was the same
The thoracic part of the spinal cord	The thoracic area of the spinal column presents a slight kyphosis, while there is a striking flatness in the same area

The position of the shoulders	The shoulders are slightly protracted.
Chest area / sternum.	The chest area of the patient presents a forward protraction. No sign of flatness is present. No sign of any deformity of the chest/sternum area.
The shape of the spinal column	The normal curvatures that are expected seem to be present in the spinal column of the patient. There are some points that present flatness and there is also cervical kyphosis but generally the shape of the spinal column is good
Position of the head	The head is moving forward in comparison with the rest of the body of the patient

Table no. 20 - Examination by observation of the lateral side of the body of the patient – Final Kinesiology Examination

Posterior/Dorsal View

Symmetry [roundness] and position of the heels	The heels present symmetry concerning the roundness of them and they don't have a lot of distance between them. The base of the patient is relatively small. The lower extremities of the patient present valgosity.
Symmetry and thickness of the Achilles tendon	Both Achilles tendons were symmetric. There wasn't some excessive loading on both of them.
Symmetry of the calves area	The calves didn't seem to present symmetry. The difference was observed mainly on the lateral aspect of the left calf area.
Poplittea Fossae symmetry	The poplittea fossa of the left lower extremity is located higher than the right one. Also on the left area of the poplittea fossae are more exposed the varicose veins of the patient
Symmetry of the thigh area	The thighs didn't present symmetry. From the medial aspect the right thigh is deviated more to a medial direction. The left thigh area presents bigger concavity than the right one. Generally the right thigh seems to overtaking the left one and that can be seen especially on the caudo-medial part of it
Symmetry of the sub-glutei lines	The left sub-glutei line is higher than the right one.

Symmetry of the tonicity of the glutei area muscles	**The tonicity of the gluteal area muscles was improved (improved)**
Symmetry of the iliac crests	**The lateral tilt of the pelvis to the right was decreased (improved)**
Symmetry of the posterior superior iliac spine	**The difference between the left and the right one P.S.I.S was decreased (improved)**
Axillary triangle – Symmetry of the trunk outline.	The right axillary triangle is bigger than the left one. That can be seen mostly on the area near the inferior angle of scapulae and near the pelvic crests.
Position of the inferior angle of the scapulae	The right scapula is placed more caudally in relation to the left one.
Position of the medial margin of the scapulae.	The right scapula presents abduction. On the other hand the left scapula presents adduction towards the spinal column.
Symmetry of the shoulder joint position	The left shoulder is placed in a higher position than the right one
Symmetry of the auricles	The left auricle is placed higher than the right one
Position of the head	The head is rotated to the left compared with the rest of the body of the patient

Table no. 21 - Examination by observation of the posterior view of the patient's body – Final Kinesiology Examination

3.7.2 Gait examination – and performance of any possible modifications– Final Kinesiology Examination

The patient is using the three point walking stereotype
The patient seems to be confident while walking with the crutches
There is a small rotational movement of the pelvis in the right and left direction
No movement of the shoulder area [soldier like position of the upper part of the trunk which is adopted the whole time of the walking]
The deviation of the body to the right was slightly decreased
The full extension of the lower extremity in the knee joint during the gait is decreased
The steps that the patient performs are symmetrical but big enough
The velocity with which the patient is walking could not be characterized as nor fast neither slow
There is full contact of both feet on the floor
During the performance of steps the first contact with floor was performed with the heel

and then the rest of the plantar surface of the foot
The right lower extremity was performing bigger step than the left lower extremity

Table no. 22 - Gait Examination and performance of any possible modification – Final Kinesiology Examination

3.7.3 Examination of the post-surgical incision/scar (observation and application of soft-tissue techniques according to K. Lewit) – Final Kinesiology Examination

The examination of the post-surgical incision as a part of the final kinesiology examination was performed under the same principles as in the initial kinesiology examination. The results were the same as there was no restriction in the different directions that were examined. The particular result of the final kinesiology examination of the post-surgical incision doesn't surprise as during the therapeutic program no restriction was recorded.

3.7.4 Anthropometry measurements applied on the lower extremities (lengths and circumferences] – checking for the presence of swelling on the LE) – Final Kinesiology Examination

The application of the measurement examination followed the exact same principles as the one followed during the first time. That means that:

- The starting position of the patient was the same → supine-lying position on the examination bed.
- The associated body segments (lower extremities) were as much as possible naked.
- Like during the first time the particular examination took place no signs of pain were recorded.

The evaluations that performed were:

- The length of the whole lower extremities
- The length of the individual segments of the lower extremities [calf/thigh/small foot area]
- The circumference of the individual segments of the lower extremities [thigh/knee joint/calf/ankle joint/metatarsals]

Length of the whole lower extremity (cm)

Measuring parameter	**Right L.E (Dx.)**	**Left L.E (Sin.)**
Anatomical Length	81cm	81cm
Functional Length [measured from the umbilicus]	98cm	98cm
Functional Length [measured from the A.S.I.S]	97cm	97cm

Table no. 23–Anthropometry measurements – Evaluation of the length of the whole lower extremity – Final Kinesiology Examination (cm)

Length of the individual parts of the lower extremity (cm)

Measured body segment	**Right L.E (Dx.)**	**Left L.E (Sin.)**
Thigh	40cm	40cm
Calf	42cm	43cm
Small foot area [metatarsals]	25cm	25cm

Table no. 24 - Anthropometry measurements – Evaluation of the length of the individual parts of the lower extremity – Final Kinesiology Examination (cm)

Anthropometry measurements (cm)

Measured body segment	**Right L.E**	**Left L.E**
Thigh [measured 10cm above patella – for checking Vastus Medialis for any possible hypotrophy]	44,5 cm	45,5 cm
Thigh [measured 15cm above patella – for checking Quadriceps Femoris m. as a whole]	46,5 cm	46,5cm
Patella – Knee joint	41.5	42
Calf [measured on the site if the highest volume]	37	37
Ankle joint	25,5	26
Metatarsals	22	23

Table no. 25 - Table of Anthropometry measurements applied on the lower extremities – Final Kinesiology Examination (cm)

3.7.5 Palpation of the muscle groups of the lower extremities for the evaluation of their tonicity

The performance of the palpation of the muscles for the evaluation of their tonicity was done according the principles as in the initial kinesiology examination. The difference between the tonicity of the muscles that were treated compared with their initial state is very big.

Results:

Examined muscle	**Right lower extremity**	**Left lower extremity**
Tibialis Anterior muscle	Normal tonicity	Normal tonicity
Tibialis Posterior muscle	**Normal tonicity (improved)**	**Normal tonicity (improved)**
Soleus muscle	Decreased tonicity	Decreased tonicity
Gastrocnemius muscle	Decreased tonicity	Decreased tonicity
Rectus Femoris muscle	**Normal tonicity**	**Normal tonicity**

	(improved)	**(improved)**
Vastus Medialis muscle	Decreased tonicity	Decreased tonicity
Vastus Lateralis muscle	Decreased tonicity	Decreased tonicity
Biceps Femoris muscle	**Normal tonicity (improved)**	**Normal tonicity (improved)**
Semitendinosus muscle	Normal tonicity	Normal tonicity
Semimembranosus muscle	Normal tonicity	Normal tonicity
Tensor Fasciae Latae muscle	**Slight improvement**	**Slight improvement**
Adductor Brevis muscle	Increased tonicity	Increased tonicity
Adductor Longus muscle	Increased tonicity	Increased tonicity
Gluteus Medius muscle	**Normal tonicity (improved)**	**Normal tonicity (improved)**
Gluteus Maximus muscle	**Normal Tonicity (improved)**	**Normal tonicity (improved)**

Table no. 26 – Palpation of the muscle groups of the L.E for the evaluation of their tonicity – Final Kinesiology Examination

3.7.6 Evaluation of the available range of motion (R.O.M) of the Lower Extremities according to the principles of H.O. Kendall – Final Kinesiology Examination

The evaluation of the range of motion of the lower extremities followed the same principles as during the initial kinesiology examination.
For the execution of the procedure:

- A unilateral goniometer containing an axis, a moving and a stationary arm was used
- The measured body segments (lower extremities) were as much as possible naked

Movements: Flexion and Extension

Extension – 0 – Flexion	**Right L.E (Dx)**	**Left L.E (Sin)**
Active **(improved)**	**S 10**^{0} - 0 - **110**^{0}	**S 10**^{0}- 0 - **115**^{0}
Passive **(improved)**	**S20**^{0} – 0 -- **120**^{0}	**S 10**^{0} – 0 – **120**^{0}

Table no. 27 - Evaluation of the available range of motion of the Lower Extremities according to H.O. Kendall– Final Kinesiology Examination.

Movements: Abduction and Adduction

Abduction – 0 – Adduction	**Right L.E (Dx)**	**Left L.E. (Sin)**
Active **(improved)**	**F 45**^{0} -- 0 -- **20**^{0}	**F 40**^{0}-- 0 -- **20**^{0}
Passive **(improved)**	**F** 55^0 -- 0 -- 25^0	**F 45**^{0}-- 0 -- **25**^{0}

Table no. 28 - Evaluation of the available range of motion of the Lower Extremities according to H.O. Kendall– Final Kinesiology Examination.

Movements: External Rotation and Internal Rotation

External Rotation – 0 – Internal Rotation	**Right L. E. (Dx.)**	**Left L. E. (Sin)**
Active **(improved)**	**R 40**^{0} – 0 -- **35**^{0}	**R 45**^{0}-- 0 -- **30**^{0}
Passive **(improved)**	**R 45**^{0}-- 0 -- **50**^{0}	**R 50**^{0}-- 0 -- **45**^{0}

Table no. 29 - Evaluation of the available range of motion of the Lower Extremities according to H.O. Kendall- Final Kinesiology Examination

3.7.7Manual muscle strength testing of the muscle groups of the lower extremities according to the principles and grading of H.O Kendall – Final Kinesiology Examination

The performance of the manual muscle strength testing was executed according to the principles and grading of H.O. Kendall.

Examined muscle	**Right lower extremity**	**Left lower extremity**
Hamstrings group of muscles	4	4
Gluteus Maximus m.	3	3
Quadriceps Femoris m.	4	4
Iliopsoas m.	4	4
Adductors group of muscles	**4 (improved)**	**4 (improved)**
Abductors group of muscles	**4- (improved)**	**4-(improved)**
Tibialis Anterior m.	4	4
Triceps Surrae m.	**4+ (improved)**	**4+ (improved)**

Table no. 30 - Muscle Strength testing according to the principles and grading of H.O. Kendall – Final Kinesiology Examination

3.7.8 Muscle Length test of the muscle groups of the lower extremities according to the principles of H.O. Kendall and the grading of V. Janda– Final Kinesiology Examination

Measured muscle group	**Right L.E**	**Left L.E**
Rectus Femoris muscle	No shortness	No shortness
Iliopsoas muscle	No shortness	No shortness
Tensor Fasciae Latae	**Decreased shortness (improved)**	**Decreased shortness (improved)**
Hamstrings group of muscles	**No shortness (improved)**	**No shortness (improved)**

Table no. 31 - Muscle Length test of the muscle groups of the lower extremities according to the principles of H.O. Kendall and the grading of V. Janda – Final Kinesiology Examination

3.7.9 Neurological Examination – Final Kinesiology Examination

The neurological examination that was performed included:

- Subjective light touch
- Light touch examination
- Deep sensation examination
- Position sense examination

Starting position

For the performance of all the neurological examinations the patient was in supine position on the examination bed.

Subjective light touch

There was normal sensation on both lower extremities

Light touch examination

There sensation on both lower and upper extremities. The body segments that were examined were:

- Shoulder girdle area [C4]
- Medial and lateral aspect of the forearm [C6 and T1]
- Thumbs and little fingers [C6 and C8]
- The ventral aspect of both thighs [L2]
- Medial and lateral aspect of both calves [L4 and L5]
- Little toes [S1]

Deep sensation examination

There was normal sensation on both upper and lower extremities

Position sense examination

The patient was able to recognize the change in the position of the several body segments. The big toes as well the 2^{nd} till 5^{th} fingers were examined for the evaluation of the position sense.

Conclusion of the neurological examination

Even before the beginning of the therapeutic unit of the patient, according to the medical documentation the neurological sensations were all the same with no alternation. During the initial kinesiology examination there wasn't observed something different and there wasn't also some alternation through the whole therapeutic unit.

3.7.10 Application of joint play examination according to the principles of K. Lewit – Final Kinesiology Examination

The performance of the joint play examination as a part of the final kinesiology examination was very decisive for the picture of the joints of the lower extremity of the patient. The reason was that from the beginning a restriction in the movement was found and also the main/chief complaint of the patient was instability that she was feeling in the area of both knees during the performance of activities such as walking, getting up the stairs, and standing up from sitting/lying position e.t.c.

The performance of the joint play examination was done according the principles of K. Lewit and under the same conditions as the first examination was performed. The examination included:

- Examination of the tibio-fibular joint in ventral and dorsal direction and
- Examination of the patella in all directions (medial-lateral-caudal and crania)

Results

Examined body segment	Right L.E	Left L.E
Tibio-fibular joint [movement into anterior and posterior direction]	No restriction was found	No restriction was found
Patella [movement into all directions]	**No restriction was found (improved)**	No restriction was found

Table no. 32 - Application of Joint Play according to the principles of K. Lewit – Final Kinesiology Examination.

3.7.11 Examination of the balance of the patient - in sitting and standing position according to the principles of V. Janda – Final Kinesiology Examination

During the therapy program that I applied with the particular patient the improvement of the balance of the patient either in sitting or standing position was a big concern. During the six sessions that I performed with the patient a lot of exercises were performed that were aiming into the improvement of the balance. Also important is to mention that one of the main complaints of the patient were the decreased balance that she was feeling during walking / getting to standing position or getting up/down the stairs.

The examination of the current state of balance took place according to the principles of V. Janda and was performed both in sitting and standing position like during the initial kinesiology examination. The additional exercise that we performed during the final kinesiology examination – taking in consideration the therapy and the exercises that had been performed prior to the final kinesiology examination were the testing of the balance of the patient while she was in standing position after the falling prevention e.t.c. The results of the examination indicated a very big improvement of the stability of the patient

3.7.12 Evaluation of the effect of the therapy

The patient was in a post-surgical operation of total hip replacement. The particular surgical operation took place nearly three months ago. The patient after the carrying out of the surgical operation started attending a physical therapy program in the outpatient department of rehabilitation of Ústřední vojenská nemocnice.
The condition of the patient from the first time that I consulted her was very satisfactory. The patient didn't have any kind of pain concerning the operated lower extremity of hers or the non-operated one. No sign of dizziness or some other unpleasant feeling was recorded during the performance of the daily living activities of the patient or walking.

The associated therapy session with the patient started on the 16th of January 2012. It lasted two weeks and each week I was consulting my patient three times for approximately 30→40 minutes.
During the initial kinesiology examination that was performed at the beginning there were noticeable some muscle imbalances throughout the body of the patient. The stability of hers was pretty good for her state and her main complaint was the instability she was feeling on her knee joints during the performance of walking.

The therapy program that I applied during the first week had as a goal the as much as possible correction of those muscle imbalances. For that reason exercises aiming into the strengthening of the weak muscles, exercises for stretching the shortened muscles and post-isometric relaxation techniques for the ones presenting increased tonicity were applied. At the same time exercises that were aiming into the increase of the sensory perception of the patient and improvement of the stability were performed.

During the second week of the therapy session I concentrated more on the exercises for the increase of the proprioception, the improvement of the balance and co-ordination of the patient. More difficult exercises and more therapeutic equipments were used for that reason.
I would like to consider my therapy program successful enough since the patient didn't have any complaint concerning her state and she was able to perform the daily living activities of hers without some kind of restriction. Also the final kinesiology examination showed some improvement in comparison with the initial one.

4. Conclusion

4. Conclusion

The end of the therapy session found Mrs. C.N. very satisfied.
The patient very soon after the surgical operation of total hip replacement started attending a physical therapy program for her rehabilitation and the normal integration in the daily living activities. At the beginning of the whole process the patient was already in a pretty much good condition. There were some muscle imbalances and some problems concerning the knee joint and the stability of the patient. My whole therapy concentrated on dealing with those instabilities but mainly improving the sensory perception of the patient, thus making more stabile the knee joint of the patient – which was the main complaint of her and improving as much as possible the balance of her.
One of my concerns about the therapy program was the thoughts of the patient concerning that. I asked my patient to tell me if she had any kind of complaint concerning me, my program or if she felt that something disturbed her through the whole procedure. Hopefully the answer of the patient was negative, telling me that she was very satisfied.
But also I was very satisfied by my patient because at the first point she accepted to co-operate with me and help me get more experience.

5. List of Literature

5. List of Literature

Following is a list of the material, websites, books, pictures I used during bringing together the final form of my Bachelor Thesis

1. About.com Orthopedics (online) 26th of February 2012, Considering hip replacement surgery? What you need to know about hip replacement, retrieved from: http://orthopedics.about.com/od/hipreplacementsurgery/tp/hipreplacement.htm

2. A hip with osteoarthritis, picture retrieved from the web address: http://orthoinfo.aaos.org/topic.cfm?topic=A00377

3. American Academy of Orthopaedic Surgeons, OrthoInfo.org (2012) Total Hip Replacement, retrieved from: http://orthoinfo.aaos.org/topic.cfm?topic=A00377

4. Balentine R.J., Shiel C. W. Jr. MedicineNet.com (2005) Total Hip Replacement, retrieved from:http://www.medicinenet.com/total_hip_replacement/article.htm

5. Basic total hip replacement precautions, picture retrieved from: http://www.upmc.com/patients-visitors/education/rehab/Pages/basic-total-hip-replacement-precautions.aspx

6. Biceps Femoris muscle, picture retrieved from the web address: http://en.wikipedia.org/wiki/Biceps_femoris_muscle

7. Black T. M., Folkens A. P., White D. T. (2012) Human Osteology, third edition, pages:, ISBN: 978-0-12-374134-9, publisher: Elsevier Academic press

8. Cluett J. M.D. About.com Guide (2011) Hip Replacement Implant Options, retrieved from: http://orthopedics.about.com/od/hipkneereplacement/a/implants.htm

9. Cluett J. M.D. About.com Guide (2008) What are my restrictions after hip replacement? Retrieved from : http://orthopedics.about.com/od/hipkneereplacement/f/precautions.htm

10. Drake L. R., Mitchell W.M. A. (2009) Gray's Anatomy for students, second edition, pages: 533→535, ISBN: 978-0-443-06952-9, cited the 20th of March 2012, publisher: Churchill Livingstone-Elsevier

11. Eustic C. About.com (2010) 6 Tips for Osteoarthritis prevention, retrieved from: http://osteoarthritis.about.com/od/jointprotection/a/OA_prevention.htm

12. Eustice C. About.com (2008) Hip Osteoarthritis – What you need to know – an overview of hip osteoarthritis, retrieved from: http://osteoarthritis.about.com/od/hiposteoarthritis/a/hip_OA.htm

13. Examples of total hip replacements, picture retrieved from the web address: http://www.medicaldevice-network.com/features/feature42813/feature42813-2.html

14. Frontera R. W., Rizzo Jr. D. Th., Silver J.K. (2008) Essentials of Physical Medicine and Rehabilitation: Musculoskeletal Disorders, Pain and Rehabilitation, second edition, pages:, ISBN: 978-1-4160-40007-, publisher: Elsevier Health Sciences division

15. Gilroy M. A., MacPherson R. B., Ross M. L. (2006) Thieme: Atlas of Anatomy, edition: first english translated, page:366, ISBN:3-13-142081, publisher: Thieme publishing company

16. Gluteus Maximus muscle, picture retrieved from the web address: http://www.audreysmassage.com/featurepage/gluteal.html

17. Gluteus Medius muscle, picture retrieved from the web address: http://www.audreysmassage.com/featurepage/gluteal.html

18. Gluteus Minimus muscle, picture retrieved from the web address: http://www.audreysmassage.com/featurepage/gluteal.html

19. Hamill J., Knutzen M. K. (2009) Biomechanical Basis of Human Movement, third edition, pages: 197→203, ISBN-13: 978-0-7817-9128-1 , ISBN-10: 0-7817-9128-6, publisher: Lippincott Williams & Wilkins

20. Hip components – hip implants, picture retrieved from the web address: http://evertsmith.com/innovations/

21. Important hip replacement precautions, picture retrieved from the web address: http://hipreplacementsurgeryrecovery.org/five-important-hip-replacement-precautions

22. Jalovcova M. (2009) Basic Therapeutic Methods I: Evaluation of motion of joint, Lecture notes, Charles University in Prague

23. Jalovcova M. (2009) Basic Therapeutic Methods I: Gait Examination, Lectures notes, Charles University in Prague

24. Jones C. Edward (2004) Conservative management of osteoarthritis, retrieved from: http://www.hss.edu/conditions_conservative-management-of-steoarthritis.asp

25. Kendall P.F., McCreary K. E., Provance G.P., Rodgers Mc. M., Romani W. A. (2005) Muscles: Testing and Function with Posture and Pain, fifth edition, pages: , ISBN 13: 978-1-4511-0431-8, publisher: Lippincott Williams and Wilkins

26. Lewit K. (2010) Manipulative Therapy in Rehabilitation of the Locomotor System, first edition published in English, pages:, ISBN:9-780-7020-3056-7, publisher: Churchill Livingstone, Elsevier

27. Male Pelvis, picture retrieved from the web address: http://www.bartleby.com/107/illus241.html

28. McRae R. (2006), Pocketbook of Orthopaedics and Fractures, second edition, pages: 423→431, ISBN: 0-443-10272-4, publisher: Churchill Livingstone-Elsevier

29. Mosby (2009) Mosby's Medical Dictionary, eight edition, ISBN: 978-0-323-05290-0, publisher: Mosby-Elsevier

30. Muscles of the iliac and anterior femoral regions, picture retrieved from the web address: http://www.bartleby.com/107/127.html

31. Nayagam S., Solomon L., Warwick D. (2009) Apley's System of Orthopaedics and Fractures, ninth edition, pages:87→97, 522→523 , ISBN-13: 978 0 340 942 055, publisher: Butterworths Medical Publications

32. Normal hip anatomy, picture retrieved from the web address: http://orthoinfo.aaos.org/topic.cfm?topic=A00377

33. Pabst R. , Putz R. (2006) Sobotta: Atlas of Human Anatomy – Tables of muscles, joints and nerves, 14th edition, page(s): 52nd , publisher: Elsevier Urban & Fischer

34. Muscles of the iliac and anterior femoral regions. (Rectus femoris visible near center.), picture retrieved from the web address: http://en.wikipedia.org/wiki/Rectus_femoris

35. Right hip-joint from the front, picture retrieved from the web address: http://www.bartleby.com/107/92.html

36. Muscles of the gluteal and posterior femoral regions. Semimembranosus labeled at bottom left., picture retrieved from the web address: http://en.wikipedia.org/wiki/Semimembranosus_muscle

37. Muscles of the gluteal and posterior femoral regions. Semitendinosus labeled at bottom left., picture retrieved from the web address: http://en.wikipedia.org/wiki/Semitendinosus_muscle

38. ThadaniR., Buzzle.com (2010) Thigh pain after hip replacement, retrieved from: http://www.buzzle.com/articles/thigh-pain-after-hip-replacement.html

39. What is hip replacement – prosthetic joint, picture retrieved from the web address: http://www.thirdage.com/hc/p/14822/what-is-hip-replacement

6. List of pictures

6. List of pictures

Following is a detailed list with all the pictures and imaging agents that were used in the theoretical division of the Bachelor Thesis.

7. Supplements

7.1 List of tables

Following is a list of all the tables that were used in the theoretical and practical part of this Bachelor Thesis

7.2 Abbreviations

m. = muscle
L. = Latin definition
L.E. = Lower Extremity
O.A. = Osteo arthritis
I.R = Internal Rotation
A.N. = Avascular Necrosis
R.A. = Rheumatoid Arthritis
X-ray = Radiography
M.R.I. = Magnetic Resonance Imaging
DVT = Deep Venous Thrombosis
A.D.L. = Activities of Daily Living
U.V.N. = Ústřední Vojenská Nemocnice
A.S.I.S. = Anterior Superior Iliac Spine
P.S.I.S. = Posterior Superior Iliac Spine
L.E. = Lower Extremity
Dx. = Dextra – Right
Sin. = Sinistra – Left
R.O.M = Range of Motion
S.F.T.R. = The particular term is used in the evaluation of the available range of motion of the lower extremities. It stands for:
- S = Sagittal plane
- F = Frontal plane
- T = Transversal plane
- R = Rotation
P.I.R. = Post Isometric Relaxation technique

Application for Ethics Board Review