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A case study of the Physiotherapy treatment of gonarthrosis (arthrosis of the knee joint).

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ABSTRACT

Title: A case study of the Physiotherapy treatment of gonarthrosis (arthrosis of the knee joint).

Thesis aim: The following case study was conducted on a 70-year old woman in February 2012 with the diagnosis of gonarthrosis (arthrosis of the knee joint) at Revmatolicky Ustav. The aim of the thesis was to report the case study of gonarthrosis (arthrosis of the knee joint) and review knowledge about anatomy, neurology, kinesiology and pathology underlying the patients condition, and in addition an attempt to review the development of this diagnosis. The second part includes the patients anamnesis, kinesiological examinations and the therapy itself in details.

Clinical findings: The patient recently was operated for the gonarthrotis with a total endoprosthesis, and pain, decreased range of motion and lack of muscle strength that usually follows after this was treated, and the treatment showed great progress in terms of development of the above mentioned.

Results: After the 7 treatment sessions the patient underwent great progress in terms of pain, range of motion and muscle imbalance.

Methods: Along with therapeutic procedures taught from the Faculty of Physical Education and Sports, the procedures included: soft tissue techniques by Lewit, post isometric relaxation by Lewit and various strength exercises. The patient was also instructed to perform self-therapy that was taught during the therapy sessions.

Conclusion: The result that has been assessed in the end shows the effectiveness of the therapies that was performed during the therapy sessions.

Keywords: Gonarthrosis, Arthrosis, Knee joint, Case study Physiotherapy

DECLARATION

I hereby declare that this is entirely my own work based on knowledge from books, journals, reports and attending lectures and seminars at FTVS, and under guidance of my advisor Mgr. Lenka Satrapová and my supervisor Bc. Maja Špiritović.

I also declare that that no invasive methods were used, and the patient was fully aware of all treatment at any time during the whole treatment period.

Prague, the 30th of August, 2012 Eirik Tempelhaug

AKNOWLEDGEMENTS

This thesis would never have been made if it weren't for my family. I would like to thank both of my parents in particular sincerely, for all of their support, in every possible meaning of the word. A special thought to my father who is a Physiotherapist, and a big inspiration to me. Without my mother and father I wouldn't be what I am today.

I would like to deeply thank my teachers, who has helped and guided me into how to treat patients with the best care. And at last, I would like to thank my advisor, Mgr. Lenka Satrapová, who has helped me in the last few years of my studies, and for helping me with her knowledge and experience in the best possible way, with her kindness and positivity. Thank you for your commitment!

TABLE OF CONTENTS

1. INTRODUCTION

We depend on movement of the body, and every part of the body is perfectly designed for locomotion. The simplest organisms in the body make up our bones and muscles, everything intended to make movement possible. And everything is as important. If one part fails, it affects the whole body. The knee joint is as simple to understand as it gets. It has the ability of doing only two things during locomotion: it either flexes or it extends, but together with the other joints of the body it enables us to move from one point to another. And every joint contributes to this, not only the joints in the lower extremities. Major operations to the knee joint can cause changes in terms of neurology, strength, range of motion and persisting pain.

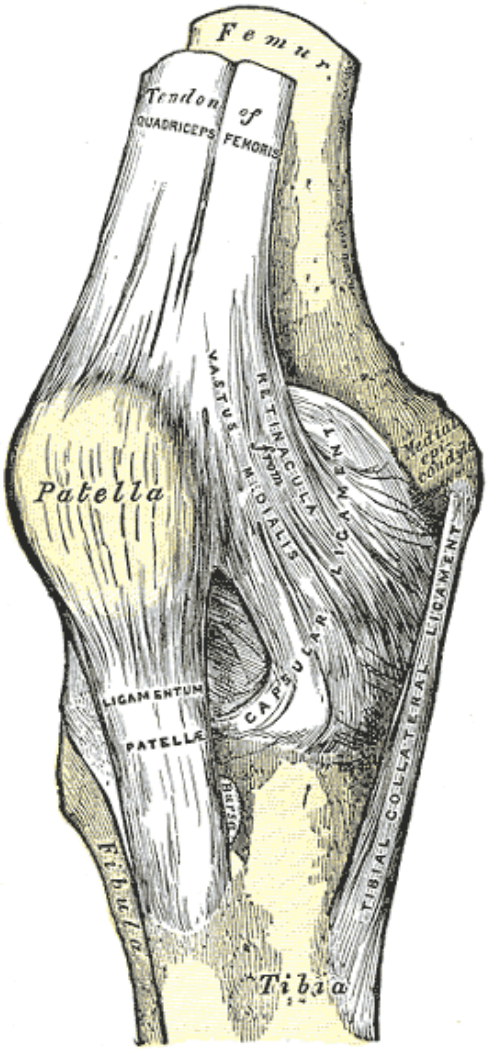
As it will be exposed in the special part, the case study that has been conducted at Revmatolicky Ustav in February 2012 will show the difficulties present when the conservative treatment has failed, and operation has been needed. The first part will be a general part, reviewing the relevant anatomy, neurology, kinesiology, pathology and available treatment relevant to the diagnosis.

2. GENERAL PART

2.1 Overview of the knee

2.1.1 Anatomy of the knee

The knee joint is the largest synovial joint found in the body, and the joint consists of the articulation between the femur and tibia, and the articulation between the patella and the femur. The articulation between the femur and tibia is the weight bearing part, while the articulation between the patella and the femur serves to protect and allow the quadriceps muscle to be directed anteriorly over the knee without tearing of the tendon.



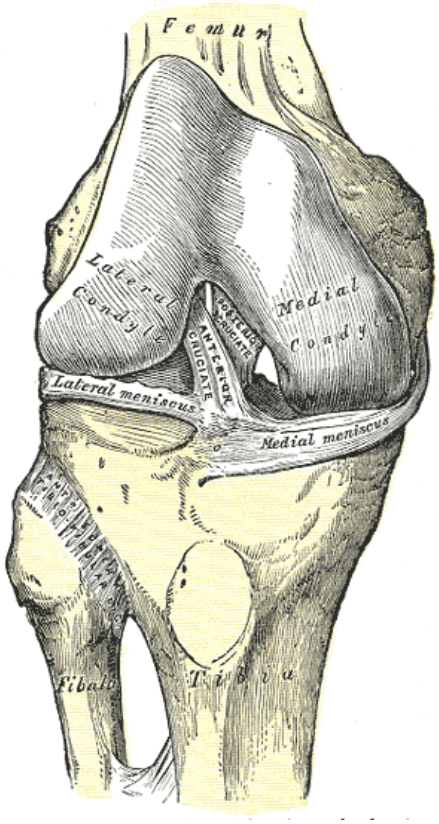
Picture 1: Illustration showing the anterior aspect of the knee, and the joining of the femur, patella, tibia and the ligaments connecting it (Standring 2008).

The knee joint is a hinge joint: the same kind of joint found in e.g. the toes and the elbow, but differs from the knee joint as the knee joint is a synovial joint. Hinge joints are the simplest kind of joints, allowing only two kinds of movement, front and back, flexion and extension. It prevents twists, rotatation and side bending by its strong collateral ligaments, which is crucial to keep the joint steady to make locomotion efficient and prevent injuries. Hinge joints are especially beneficial for weight bearing joints like the knee joint with its articulation between the femur and tibia. Because it is a weight bearing joint, the knee joint has an efficient lock mechanism, allowing a reduction of the amount of energy the muscles have to use to keep the joint extended while a person is standing. One component of the locking mechanism is a change in the shape and size of the femoral surfaces that articulate with the tibia:

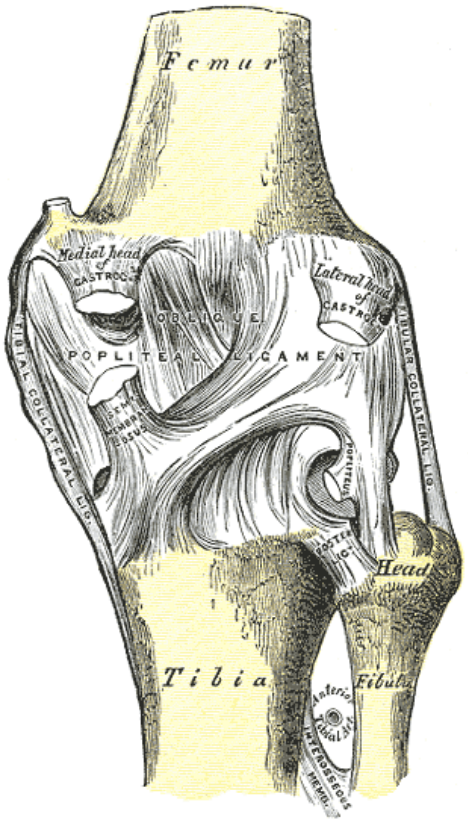
- In flexion, the surfaces are the curved and rounded areas on the posterior aspects of the femoral condyles
- As the knee is extended, the surfaces move to the broad and flat areas on the inferior aspects of the femoral condyles (Drake 2010).

The ligaments provide the necessary stability that is needed in the knee joint. They are:

- **The anterior cruciate ligament (ACL)** and the **posterior cruciate ligament (PCL)** which are situated in the middle of the knee in a cross, providing the necessary stability in the knee joint during movement and makes sure the weight is equally transmitted
- **The medial collateral ligament (MCL)** and **the lateral collateral ligament (LCL)** on each side of the knee with the function of stabilizing the knee in side-to-side movement
- **The transverse ligament**, connecting the lateral meniscus to the medial meniscus
- **The posterior meniscofemoral ligament** and **the anterior meniscofemoral ligament**, from the lateral meniscus to the medial femoral condyle
- **The meniscotibial ligaments**, from the inferior angles of the meniscus to the tibial plateau
- **The patellar ligament**, connecting the patella to the tuberosity of the tibia (Snell 2011)

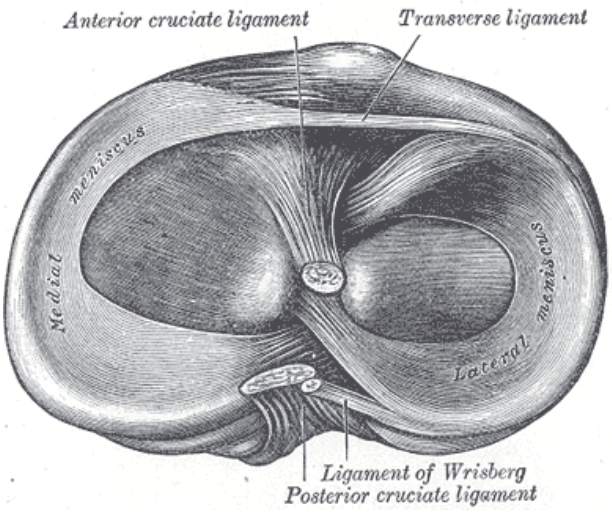


Picture 2: Showing the interior ligaments from the anterior aspect of the knee joint, with the patella removed (Standring 2008).



Picture 3: Showing ligaments of the knee joint from a posterior view (Standring 2008).

Inside the knee joint the **medial** and the **lateral meniscus** is found. Both are attached at each end to facets in the intercondylar region of the tibial plateau. They serve to divide the weight in the knee and to reduce friction during movement. The medial meniscus is attached around its margin to the capsule of the joint and to the tibial collateral ligament, whereas the lateral meniscus is unattached to the capsule. Therefore, the lateral meniscus is more mobile than the medial meniscus (Drake 2010).



Picture 4: Shows an illustration of the head of the right tibia seen from above, showing the meniscus and the attachment of the ligaments (Standring 2008).

Within the knee joint there is cartilage, serving as a shock absorber

to the knee from the load it is carrying and allows flexibility in the joint during e.g. walking. Cartilage is a connective tissue, although it differs from other connective tissues by the fact that it doesn't contain any blood vessels, and grows and repairs more slowly (Snell 2011).

Together with the perfect structures of the bone and ligaments, the muscles act as as the engine of the machine, and the following muscles are acting during flexion and extension:

Muscle	Segmental innervation	Function in knee joint
Sartorius	L1, 2, 3	Medial rotation and flexion of the knee
Gracilis	L2, 3, 4	Medial rotation and flexion of the knee
Quadriceps (Rectus femoris, Vastus lateralis, Vastus medialis and Vastus intermedius	L2, 3, 4	Extension of the knee
Tensor fascie latae	L4, 5, S1	Extension of the knee
Popliteus	L4, 5, S1	Medial rotation and flexion of the knee
Plantaris	L4, 5, S1	Flexion of the knee
Semimembranosus	L4, 5, S1, 2	Medial rotation and flexion of the knee joint
Semitendinosus	L4, 5, S1, 2	Medial rotation and flexion of the knee joint
Biceps femoris long head	L5, S1, 2	Lateral rotation and flexion of the knee joint
Biceps femoris short head	L5, S1, 2, 3	Lateral rotation and flexion of the knee joint
Gastrocnemius	S1, 2	Flexion of the knee joint

Table 1: Table showing relevant muscles involved in flexion and extension of the knee and the segmental innervation (Kendall 2005).

By the iliotibial tract, the **Gluteus maximus** (L5, S1, 2) also contributes to extension of the knee joint (Snell 2012).

2.2 Neurology

The neurology regarding the knee like the rest of the human body is divided into the two subsystems the central nervous system (the brain and the spinal cord) and the peripheral nervous system and should be described separately.

2.2.1 Nervous plexuses

The muscles of the knee are innervated by nerves in the lumbar spine and the sacrum (lumbosacral plexus). The lumbar plexus is formed by the ventral primary rami of L1, 2 and 3, and a part of L4, and frequently, with a small contribution from Th12, which is the last thoracic nerve.

The sacral plexus arises from the smaller part of the ventral primary ramus of L4, and from the entire ventral rami of L5, S1, 2 and 3. The L4 and 5 ventral rami unite to form the lumbosacral trunk, which enters the pelvic cavity. There, it is joined by the ventral rami of S1, 2 and 3, forming the plexus, which then branches into anterior and posterior divisions (Kendall 2005).

2.2.2 Major peripheral nerves

There are three major nerves in the thigh, innervating muscles regarding flexion and extension of the knee. The femoral nerve is associated with the anterior compartment of the thigh, the obturator nerve is associated with the medial compartment of the thigh, and the sciatic nerve is associated with the posterior compartment of the thigh.

Femoral nerve: The femoral nerve originates from the lumbar plexus on the posterior abdominal wall and enters the femoral triangle of the thigh by passing under the inguinal ligament. In the femoral triangle the femoral nerve lies on the lateral side of the femoral artery and is outside the femoral sheath, which surrounds the vessels. Immediately after passing under the inguinal ligament, the femoral nerve divides into anterior and posterior branches, which supply muscles of the anterior compartment of thigh and skin on the anterior and medial aspects of the thigh and on the medial sides of the leg and foot (Drake 2010).

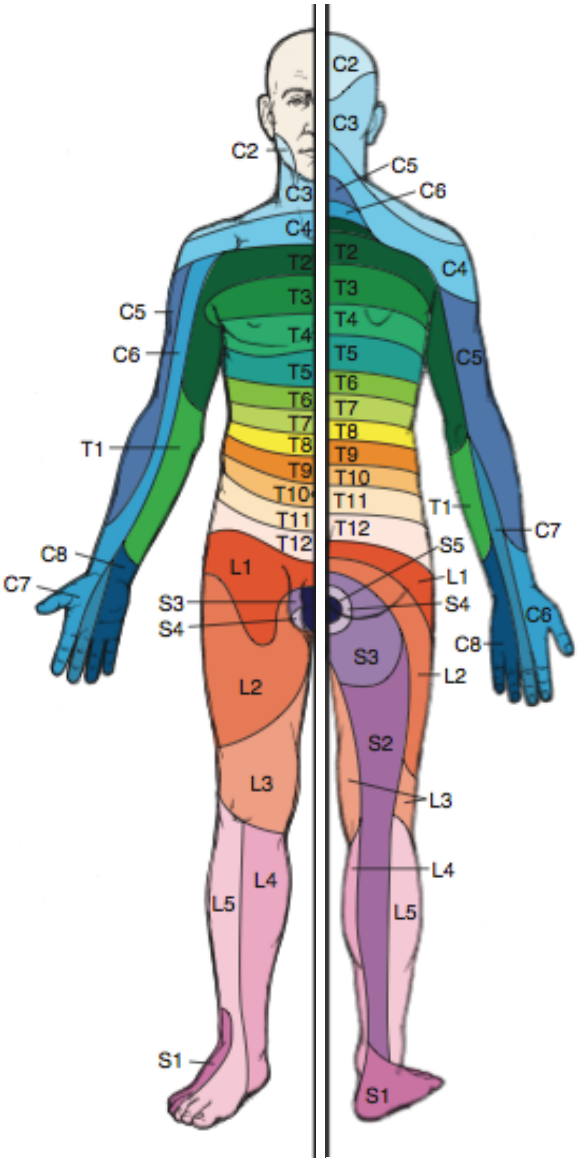
Obturator nerve: The obturator nerve is a branch of the lumbar plexus on the posterior abdominal wall. It descends in the psoas muscle, and then passes out of the

medial margin of the psoas muscle to enter the pelvis. The obturator nerve continues along the lateral pelvic wall and then enters the medial compartment of the thigh by passing through the obturator canal. It supplies most of the adductor muscles and skin on the medial aspect of the thigh. As the obturator nerve enters the thigh, it divides into two branches: the posterior branch and the anterior branch (Drake 2010).

Sciatic nerve: The sciatic nerve descends into the posterior compartment of the thigh from the gluteal region. It innervates all muscles in the posterior compartment of the thigh and then it branches continue into the leg and foot. In the posterior compartment of the thigh the sciatic nerve lies in the adductor magnus muscle and is crossed by the long head of biceps femoris. Proximally to the knee, it divides into the tibial nerve (long head of biceps femoris, semimembranosus, semitendinosus) and the common fibular nerve. These nerve travel vertically down the thigh and enter the popliteal fossa posterior to the knee (Drake 2010).

2.2.3 Dermatomes

As the muscular innervation, the relevant segments of the spine is the same as in the innervation of the skin. In the limbs, the arrangement of the dermatomes is more complicated because of the embryologic changes that take place as the limbs grow out from the body wall, whereas on the trunk the dermatomes are distributed in a more equal matter (Snell 2012).



Picture 5: Shows the dermatomes from a posterior view (Snell 2012)

Picture 6: Shows the dermatomes from a anterior view (Snell 2012)

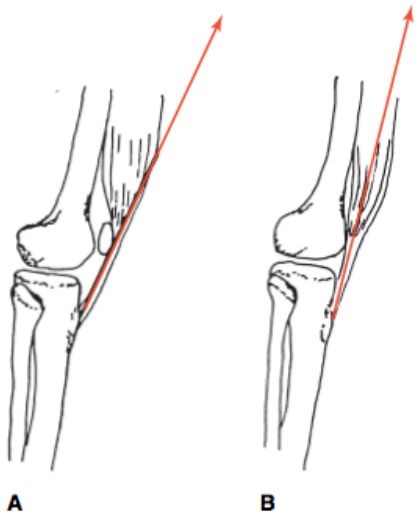
2.3 Kinesiology of the knee

The knee joint is though of as an easy joint to understand and being relatively simple in its function, however, the truth is that it is relatively complex in its way of working. Muscles and ligaments stand for all the support in the knee joint. And the further down, the more load is on the joint, and the knee joint is a place often prone to injuries, wear and tear – and is the most frequently injured joint. It is also the biggest joint in the body, classified as a synovial hinge joint, and able to perform flexion and extension, from 0 degrees to 120-135 degrees (Lippert 2011). Due to some ligament laxity, the knee may have a few degrees of hyperextension beyond 0 degrees; 5 degrees of hyperextension is considered genu recurvatum. The knee joint differs slightly from the elbow joint, which both are so called hinge joints. The knee is not a

true hinge joint, because it has not a free motion but rather an accessory motion that accompanies flexion and extension (Lippert 2011).

During flexion and extension, the articular surface of the femoral condyles is much greater than that of the tibial condyles. If the femur rolled on the tibia from flexion to extension, the femur would roll off the tibia before the motion was complete. Therefore, the femur must glide posteriorly on the tibia as it rolls into extension. It should also be noted that the articular surface of the femoral medial condyle is longer than that of the lateral condyle. As extension occurs, the articular surface of the femoral lateral condyle is used up while some articular surface remains on the medial condyle. Therefore, the medial condyle of the femur must also glide posteriorly to use its entire articular surface. It is this posterior gliding of the medial condyle during the last few degrees of weight-bearing extension (locked knee joint) that causes the femur to spin on the tibia (Lippert 2011). This contributes to a sufficient movement. A locked knee joint can make a person stand for longer durations without using muscles.

The patella plays and important role in the knee joint during muscle force. The smooth, posterior surface of the patella glides over the patellar surface of the of the femur. The main functions of the patella involve increasing the mechanical advantage of the quadriceps muscle and protecting the knee joint. By placing the patella between the quadriceps, or patellar tendon, and the femur, the action line of the quadriceps muscle is farther away – showing the importance of the patella. This allows the muscle to have greater force (Lippert 2011).



Picture 7: The first picture shows the knee joint with the patella, and the second picture shows the knee joint without the patella, illustrating the importance of the patella on context with the quadriceps (Lippert 2011).

Weight-bearing and loading in the knee joint may affect several parts of the body. We can recognize three different types of loading: Compression loading, shear loading and tensile loading. During compression loading, the force pushes the tissue together, and the load is on the bone (tibia). During shear loading, the force is causing tissue to glide against other tissues,

and the cartilage is on the end of the tibia, and tensile loading – when forces pull the tissues apart, and the load is on the ligaments of the knee. Compressive loading is a contributor to arthritis, and every 1 kg of extra body mass, the risk of developing osteoarthritis increase by 9% to 13% (Cicuttini, 1996).

2.4 The onset of degenerative changes - Arthritis

2.4.1 Introduction

A definition might perhaps be somewhat difficult to define. Getting older is not something pleasant for the human body, and it undergoes several changes in all parts. People get wrinkled skin, and the hair turns grey, yet, this shouldn't be described as a disease, it is just a part of getting old. Arthritis can also be seen as a part of getting old for many individuals. Wearing out of joints and loss of cartilage will eventually show on x-rays, and the body responds by producing new bones because of loss of the old bones. Drawing a line between "wear and tear" and "osteoarthritis" can be very difficult, and cannot only be determined only by an x-ray, as an x-ray and the pain sensation the patient is experiencing can show two different things (Moots 2004). Conventional radiography, MRI and artho CT-scanner can also be used in determining (Bonnin 2008).

2.4.2 Epidemiology

Arthritis show to some degree to strike certain groups of people. Factors are:

- Age
- Sex
- Overweight/obesity
- Hereditary
- geographic connection

Other factors are knee injury, repetitive use of joints, bone density, muscle weakness, joint laxity (Hunter 2010), and despite a lack of information as it is only in the last hundred years data has been collected, it seems to be more and more frequent.

Age is the most important factor. Although arthritis can develop at any age, it most commonly develop between the ages 40 to 60. In the United States, 13% percent of women has osteoarthritis, and for men it is 10% (Hunter 2010)

Another well known factor to develop arthritis, is the difference in the sex – whereas arthritis among women are more frequently diagnosed. For every man with arthritis, there is three women with some kind of arthritis (Moots 2004). However, it is not known why it is like this, but one factor that has recognition is hormonal differences in men and women, whereas there is higher activity among women. Yet, when it is expected that a woman with arthritis becomes pregnant would experience increased symptoms, it seems to be the opposite actually. But on the same time this contributes to the discussion between arthritis being affected by hormones.

Furthermore, a man living with arthritis tend to develop a more severe kind of the disease than women, although it has to be said that this is not a rule (Moots 2004).

Arthritis is though to be influenced by a combination of genetic and environmental factors. There is certainly a hereditary factor to it, although studies show that the occurrence among identical twins is only 30% of the cases. By that, it is said that the environmental influences are greater than the genetic influence. Genetically, it shows that the number of genes responsible is more important than finding particular genes to be responsible. However, one gene has been seen more in context with the disease: the major histocompatibility complex (MHC). It is a gene important for the immune response, and therefore it is though that the immune system is highly connected to arthritis (Moots 2004).

Arthritis doesn't show to be more common in certain races or in certain nationalities although it may be a little less common in Mediterranean areas, and research has revealed that eating a Mediterranean style diet may relieve symptoms. As diets vary a lot, this shouldn't necessarily be seen in context with race or nationality, but as a geographic pattern, together with welfare diseases common in the western world, as arthritis is often seen in patients with welfare diseases such as obesity and high blood pressure (Moots 2004).

As stated in the beginning of this topic, data have been kept only for about the last two hundred years, so determining if arthritis is getting more common is hard to say. But from these numbers it is seen that arthritis is getting slightly more common. Also the fact that that the disease haven't been described in earlier literature points to that the disease wasn't that common earlier (Moots 2004).

The degree of the condition vary from case to case. For some, arthritis can affect nearly every part of their life, with frequent therapy sessions and medical assistance, while to some the condition may be nothing more than an inconvenience in their life, having only minimal impact on their lifestyle (Arden 2008).

2.4.3 Etiology

The meniscus plays an important role in gonarthrosis. It is responsible for weight bearing load, shock absorption thus protecting the articular cartilage, joint stability by countering the tibial plateau to match the femoral condyles and distribution of synovial fluid and nutrients. In case of e.g. injury to the anterior cruciate ligament (ACL) the stability in the joint is put to task and the danger to injury in the meniscus is high. The posterior horn of the medial meniscus is the primary stabilizer to anterior translation, which places the posterior horn under loads with translation and explains the high incidence of secondary meniscal tears in chronic ACL insufficiency. Rupture of the posterior horn leads to even greater anterior translation resulting in increased instability, and arthritis is likely to ensue due to this (Bonnin 2008).

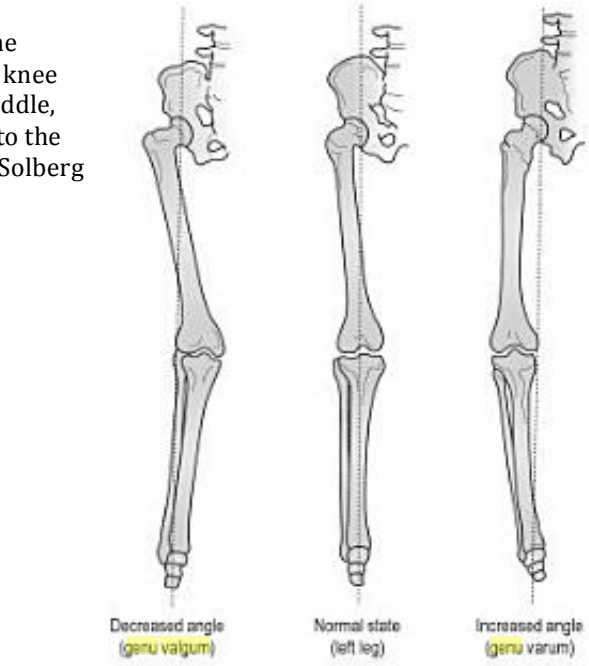
This however is a possible explanation when there is an injury primary to the osteoarthritis, and the osteoarthritis is a secondary factor. The case for elderly patients usually can be explained by more obvious reasons. Natural degeneration happens over time, and is a consequence of repeated micro traumas, related to occupation and everyday living. As a result of this the meniscus and/or the articular cartilage undergoes a continual degeneration.

While the lesions may be either meniscal or cartilaginous in origin, the modality and the rapidity of degeneration of the cartilaginous structures depend largely on local mechanism. This degeneration can occur very slowly or extremely quickly in the form of an acute flare, with an alteration in the phases of stabilization and chondrolysis (Bonnin 2008).

The synovial membrane intervenes in this process of degeneration, by the production of intermediary substances such as cytokines and metalloprotinases, many of which are destructive to the cartilage.

Another important factor to gonarthritis is the axis of the knees. A incorrect axis of the knees can surely lead to damage to the cartilage. Patients with genu

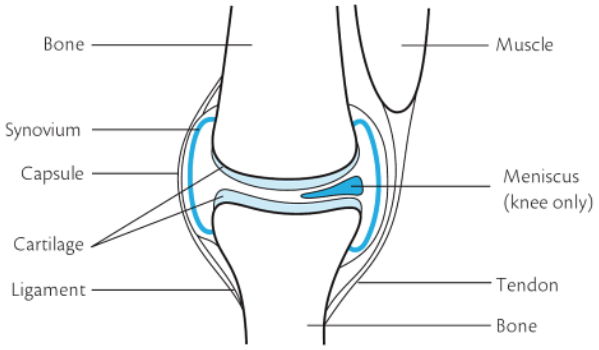
valgum will wear and tear the cartilage by increased weight bearing on the medial plateau of the tibia against the medial condyle of the femur. The deformity of genu valgum therefore relates to wear and tear to the joint. On the other hand, ganu varum leads to increased pressure on the lateral plateau of the tibia, and the lateral condyle of the femur (Solberg 2008).



Picture 8: Illustration showing the difference in the axis through the knee joint, with a normal axis in the middle, and the axis during genu valgum to the left and genu varum to the right (Solberg 2008)

2.4.4 Classification

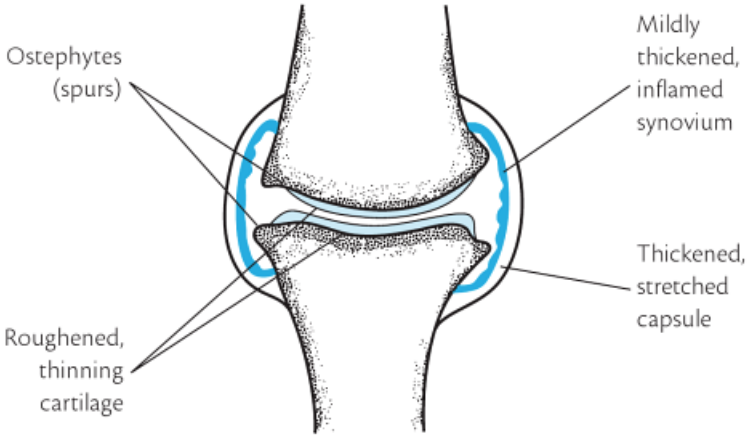
A synovial joint is made up of two bone ends, a layer of cartilage lining the end of each bone, a capsule lined by synovium which produces synovial fluid, ligaments, tendons and muscles. In a healthy joint, the role of the cartilage is to help the bone ends move smoothly and painlessly against each other when the joints are moved. The cartilage also acts as a shock absorber. This is how it works in a healthy joint. The bone tissue and cartilage are always undergoing regeneration and as long as this continues the joints work smoothly together (Bonnin 2008). However, if the cartilage



Picture 9: Figure showing a normal knee joint without arthritis (Arden 2008)

starts to diminish in size it can put strain on the other tissues, and as a result they work overtime in terms of trying to compensate. *Iwano* (Iwano 1990) (Iwano, 1990) recognizes four types or four stages of osteoarthritis:

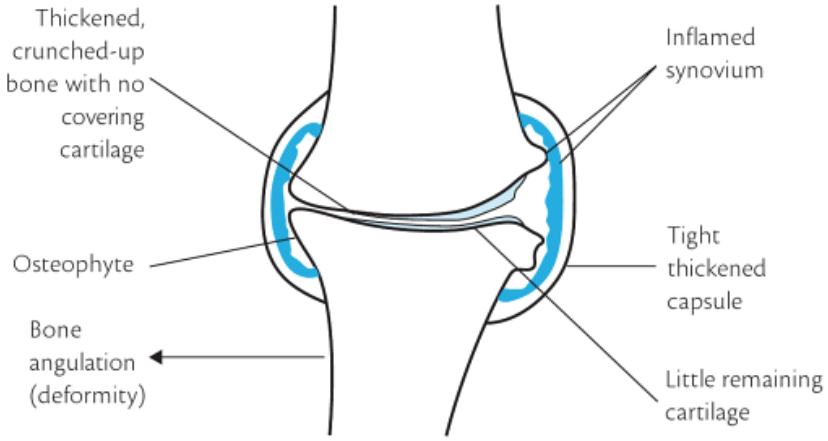
- Stage 1 – Mild osteoarthritis: With a joint space at above 3mm (Bonnin 2008). Over time the cartilage is reduced, lighter and less smooth in appearance, meaning that the bones do not move as smoothly during movement. The space between the bone ends has become slimmer caused by thinning of the cartilage, and as a result more pressure is put on the tendons and ligaments to maintain joint stability, whereas the patient will start feeling pain during joint movement. In response to the worn-out cartilage and the imbalance, small little bony branches of osteophytes will start to develop (Arden 2008).



Picture 10: Figure showing the appearance of mild arthritis in the joint (Arden 2008)

- Stage 2 – Moderate osteoarthritis: With a bone distance less than 3mm, however there is no bone to bone contact anywhere in the joint (Bonnin 2008). Treatment is needed, but surgery is not suitable at the current time.
- Stage 3 – Severe osteoarthritis: With a bony contact less than one-quarter of the joint surface (Bonnin 2008). The loss of cartilage will appear much greater on a CT-scan, including areas where the cartilage has disappeared revealing the underlying bones. The osteophytes has become bigger, and the end of the bones has started to thicken as a

reaction to the increased stresses that it experiences, caused by the loss of the shock-absorbing effect of the overlying cartilage. Debris can be found as the cartilage breaks down in the synovial fluid, which is struggling to create enough lubricant for the bone ends and the remaining cartilage (Arden 2008). Surgery is most likely needed in near future and the patient need frequent treatment in order to cope with the functionality and pain.



Picture 11: Showing a knee joint with severe osteoarthritis (Arden 2008)

- Stage 4 – Very severe osteoarthritis: Where the bone surfaces entirely touch each other (Bonnin 2008). In these cases, the pain will be great during movement, and surgery is necessary. At this point the patient will not be able to walk, and the quality of life is substantially reduced (Arden 2008).

2.4.5 Symptoms

The most common symptoms patients with gonarthrosis are experiencing are:

- **Stiffness** in the knee joint, especially morning stiffness which gradually disappears during the two first hours of the day, especially for patients in the early stages, while patients in moderate and severe stages experience the stiffness the whole time. The stiffness limits the patients range of motion (ROM), causing problems with activities of

daily living (ADL) such as getting up from a chair or the bed, to walking up the stairs. The stiffness is usually followed by a crunching sound in the knee during flexion and extension (Brown 2009).

- **Pain** in the knee joint. As for stiffness, the pain can be temporary for patients in the early stages, while patients in stage (2), 3 and 4 experience the pain the whole time (Brown 2009).
- **Swelling** of the knee, caused by an excess of fluids accumulating in the knee joint, as damage to the cartilage triggers inflammation of the joint synovium and extra production of joint fluid (Brown 2009).

Symptoms of gonarthrosis may be difficult to detect in the early stages of the degeneration, as the symptoms can come and go, and the symptoms doesn't necessarily correlate with the amount of damage there is to the joint. Because of this, it is hard to determine whether the treatment of a patient in early stages of gonarthrosis are working or not (Bonnin 2008).

2.5 Diagnostics

Determining the diagnosis divided into four groups: medical history, physical examination, imaging and laboratory tests (Eustice 2009).

Medical history is important for the diagnostics to evaluate if there is something in the patient records that would induce the arthritis, such as previous knee injuries, family anamnesis or history of overweight (Hunter 2010).

During a physical examination the doctor looks for:

- Joint swelling
- Joint tenderness
- Decreased range of motion in joints
- Visible joint damage
- Crepitus
- Pattern of affected joints (Eustice 2009)

The physical examination should be prior to the imaging and the laboratory tests.

X-ray is the most common imaging assessment tool in determining arthritis of the knee. X-ray imaging can detect osteophytes at the joint margins, subchondral bone sclerosis and the joint space narrowing, to determine the if the arthritis is on stage 1 (above 3mm distance), stage 2 (less than 3mm), stage 3 (partly bony contact) or stage 4 (full bony contact) (Bonnin 2008; Eustice 2009). MRI (magnetic resonance imaging) is also used as an imaging tool in the diagnostics, used to evaluate the cartilage, bone and the ligaments of the knee joint (Eustice 2009).

Taking a joint fluid analysis is essential in determining what type of arthritis the patient has, and ruling out other conditions that may have some of the same symptoms that gonarthrosis has. In case of gonarthrosis, the findings in the laboratory tests will show:

- Sedimentation rate less than 40mm/h
- Rheumatoid factors less than 1:40
- The synovial fluid examination showing a clear, viscous fluid with a white blood cell count less than 2000/mm3 (Eustice 2009)

2.6 Prognosis

Research shows that the majority of patients with gonarthrosis need major knee surgery (Odenbring 1991). Operation should be the last option, and the aim should always be to try conservative treatment as long as possible. If the case ends up with an operation on the other hand, the prognosis of a successful operation from the orthopedic point of view is good, as the survival rate of the orthopedic implants after 15 years is 98% (Lundblad 2008).

2.7 Treatment

2.7.1 Pharmacological treatment

The pharmacological side of the treatment is primarily focused on the degenerative cartilage in the preoperatively period in order to try to make an operation unnecessary. The medication should be adapted to the stage the patient is in (stage 1, stage 2, stage 3, stage 4) and the speed of the degeneration. One can classify the drugs

for the treatment into two groups: symptom—modifying treatments, which can be distinguished by their clinical kinetic profile (meaning onset of the response, duration and persistence of effect) and those that are generally relatively rapid acting: analgesics and NSAIDs (non-steroidal anti-inflammatory drugs) (Bonnin 2008).

2.7.2 Non-pharmacological treatment

Overweight is one of the most frequent causes of gonarthrosis, and being overweight will aggravate the arthritis. Loss of weight will both have an analgesic effect on the patient and it will slow down the process. A study on obese patients that had gastric surgery showed that 57% of the patients had knee pain prior to the surgery, whereas only 14% had knee pains after, illustrating the importance decreased body weight (Bonnin 2008).

The development of gonarthrosis is due to a lot of force to the knee joint. A way of assisting the knee joint is to wear absorbent shoes or using soft soles. As much as 40% of the force can be taken away from the joint by this (Bonnin 2008), and can therefore dramatically slow down the arthritis process. Other aids such as walking sticks can also be very beneficial for the knee as there is less weight and therefore less force directed through the knees.

2.7.3 Surgery

Arthroscopic lavage and debridement: Arthroscopic techniques for the knee are lavage and debridement, e.g. shaving of rough cartilage or smoothening of the degenerated meniscus. Arthroscopic techniques as these remove debris and inflammatory cytokines, and should therefore diminish symptoms in theory. It is widely used, although there is a lack of evidence to it. It lacks prove diminishing symptoms especially for elderly patients and those patients that are on a severe stage, but on younger patients, especially related to sports injuries and patients in a early stage of gonarthrosis there is a higher chance of improvement of the condition. The benefit of this kind of surgery is that the postoperative complications are relatively small.

Cartilage repair techniques: Repairing of the cartilage can be performed by surgery, however it has at the best only minimal healing capacity. Cartilage repair is only indicated for focal cartilage defects, which develops before the actual arthritis.

Joint arthroplasty: Arthroplasty is a frequently used technique as it is safe and cost-effective at the same time. Joint arthroplasty is mostly used in patients where other treatments have failed or the other treatment is contraindicated. The prosthetic components used today usually doesn't last any longer than 20 years, making the treatment uncommon for patients under 60 years old.

Total knee arthroplasty: TKA (total knee arthroplasty) or TEP (total endoprosthesis) is used for advanced cases, where other types of surgeries are contraindicated or unsuitable and conservative treatment has failed. TEP is very effective, and helps patients both function vice and improve the quality of life. It is a first line treatment, and at 15 years the orthopedics has a survival rate at 98%. In the postoperative stage 12,5% of the patients experience pain. One of the benefits is that patients are usually able to obtain the range of motion without invasive pain. During the surgery, special cutting instruments are used to fit the femur and the tibia for the implant. The components are divided, and there is one component for the femur and one for the tibia, whereas both are made on beforehand, meaning that it is the bones that needs to be adapted.

What has seen to be a problem is the pain in the patellofemoral joint of these patients, but benefit of patella resurfacing has never been proven. Complications involving the extensor mechanism and the patellofemoral joint remain the primary non-infectious indication for correction of the surgery (Rönn 2011).

2.7.4 Physiotherapeutic methods

The physiotherapeutic methods available for the diagnosis depends on if it is in the preoperative period – whereas conservative treatment in order to slow the process down and to act relief pain, or whether it is on the postoperative period – where rehabilitation after the operation and aiming against independent walking.

Preoperatively: In terms of pain relief, electrotherapy such as TENS (transcutaneous electrical stimulation) or EMS (electrical muscle stimulation) according to the gate theory. Ultrasound therapy is also suitable for pain relief for these kinds of patients. Thermal packs and hot lamps may also be suitable in the

preoperatively period, however they are relevant in the postoperatively period as well. This will lead to hyperemia which will reduce the pain and the muscle tenseness (Mayor 2007). It is important to use non-invasive treatments for the patient in the preoperatively period to keep the forces directed to the knee joint at the minimal, in order to prevent damage to the cartilage. Muscle strength is important in this relation. Eccentric contraction techniques are beneficial, performed in a non-weight-bearing position. Various traction techniques may also be of great value to the patient, in order to relieve pain and stiffness in the joint.

Postoperatively: The focus in the postoperative period should be in maintaining the range of motion, obtain the muscle strength that was obtained before the operation, pain relief, and have a fluent gait, which is critical for the patient connected to ADL (Bonnin 2008). Because of the orthopedic implants certain pain relief techniques should not be used, but thermal techniques such as hot pack is safe and pain relieving. The main goals should be adapted to each individual, but on a general basis most patients with a TEP usually face the same challenges, being postoperative pain, decreased ROM, lack of muscle strength/muscle imbalance, difficulties in connection to gait and difficulties related to ADL. The rehabilitation should be focused on regaining as many of the features a normal knee joint would have, and through normal activity this is obtainable, rather than immobility. Restrictions related to muscles in the postoperative period can be achieved through PIR, especially the knee extensors. This will eventually also affect the ROM.

2.8 Differential diagnosis

Being sure about the diagnosis of a patient with arthritis is difficult to question on the later stages of the disease. Testing the synovial fluid will detect it with certainty. On the early stages, micro-fractures of the bone, on the tibial plateau or the condyles of the femur can cause damage to the cartilage and resemble some of the symptoms of gonarthrosis. This will however easily be detected by diagnostics of a doctor, and will be excluded.

The different types of arthritis must be completely investigated, as well over 150 types of arthritis is recognized (Watt 1997), and medical documentation must be able to identify the state of the synovium or the cartilage. Especially in the end stage it might be difficult to diagnose exactly what kind of arthritis it is.

In order to identify the differential diagnosis, the joint must be seen as one organ, with the comprising capsule, synovium, cartilage, bone, enthesis and joint fluid. Synovial disease is a diagnosis which could possibly be in resemblance with gonarthrosis, making further investigation necessary (Watt 1997).

3. SPECIAL PART

3.1 Methodology

The case study has been conducted on Mrs M.M in February 2012. M.M is an inpatient Revmatolicky Ustav with a total endoprosthesis for gonarthrosis (M17.1) of the right knee. The patient came for treatment of in total 7 sessions, most of them lasting for the same amount of time as the other patients, and during the treatment period the patient was treated on the same basis as all of the other patients, as it was a tight schedule.

I was equipped with a private booth, and a gym with some materials. The available materials were:

- Therapy table
- Neurological hammer
- Various measuring devices
- Goniometer
- Hot lamp
- Ergometer bike
- Overball
- Elastic bands

For the purpose of this study, the patient was informed in written form (attached) about the case study, and the topic was approved by the Ethics Committee of the Faculty of Physical Education and Sport at Charles University (approval number 066/2012) on February the 17th, 2012.

3.2 Anamnesis

Examined person: Mrs. M.M. (female)

Year: 1942

Diagnosis: Total endoprosthesis for Gonarthrosis (M17.1) of right knee

Present Status:

Blood pressure: 120/75 mmHg Heart rate: 68 bpm

Height: 160 cm Weight: 70 kg BMI: 27,3

The patient is a 69 year old woman that was operated for gonarthrosis on January the 4th 2012 with arthroplasty. M.M. is fully oriented. At the first day and time of the initial kinesiological examination the patient states that the pain level is 2/10 at rest, and slightly worse during walking, but according to the patient it is not bothersome. Acute pain is only felt during flexion of the knee that exceeds 90°. The pain is rather sharp, and from the point where the first sense of pain is felt, the patient is only able to flex the knee a few degrees more until the pains become so sharp that she is unable to continue the movement. The patient doesn't seem to be anxious related to knee flexion, but it seems like the patient is unwilling to try to increase the knee flexion when she is advised to try it.

The patient has also been diagnosed with coxarthrosis, the patient doesn't experience any pain connected to this during the therapy sessions.

The patient is currently using forearm crutches for walking, and the patient is able to walk in stairs both up and down without problems. M.M. is at all times wearing compression socks.

Medical history:

Chief complaint:
The patient has no pain sensation during rest – pain is only felt during flexion of the knee. During passive flexion the patient only feels pain when the knee joint is approaching maximal flexion, and feels slight pain during the whole movement when the patient performs active knee flexion.

History of present problem:
The patient has been coming to Revmatolicky Ustav for preventive care for several years because of the gonarthrosis, but after recommendation from the doctor she was operated with right knee arthroplasty Wednesday 04.01.2012 on Ústřední vojenské nemocnice. After hospitalization at UVN the patient was taken to Revmatolocky Ustav for recovery. It has been 4 weeks since the operation.

Previous injuries: No previous injuries.

Previous operations:

- Operated for carpal tunnel syndrome, right arm (1994)

Gynecological: 2 births, 0 abortions,

Childhood diseases: Normal childhood disorders.

Chronic disorders:

- Arterial hypertension
- Chronic venous insufficiency
- Depressive syndrome
- Goiter
- Osteopenia
- Coxarthrosis (right)
- Epicondylitis (right)

Pharmacology:

- Lanzul
- Vigantol
- Vasocardin
- Tulip
- Detralex
- Citalec
- Lopaz

Allergies: No allergies.

Abuses: M.M. doesn't smoke, drinks on occasions.

Family anamnesis: There is no related diagnosis in the family.

Occupational anamnesis: The patient previously worked as a secretary in a bank, but is now retired.

Social anamnesis: M.M. is divorced, and is currently living at home with one of her adult sons.

Previous rehabilitation: No physiotherapeutic records available.

Statement from patient's medical documentation: X-ray of the patients knee joint(s), dated 16.04.12.
Result: Considerable degenerative changes in both knees.

Indication of rehabilitation: Two weeks at Revmatolicky Ustav with daily Physiotherapy with the aiming to independent ADL, prescribed by the patients doctor.

3.3 Initial kinesiological examination (01.02.12)

3.3.1 Postural Examination

*Postural examination was performed without crutches

Anterior view:

- Halux valgus of right foot
- Over pronation (standing on medial aspect of the foot), especially on the right lower limb
- Flat feet on both sides/decreased arch
- Tendency of external rotation of right lower limb
- Edema of right knee joint
- Patella on left the left side seems lower than center of right knee joint
- Anterior superior iliac spine lower on the right side than left
- Left shoulder more elevated than right

Posterior view:

- Small base of feet's
- Posterior superior iliac spine lower on the right side than the left
- Winged scapula's
- Left shoulder more elevated than right
- Edema of the right knee joint
- Iliac spine seems lower on the right side than on the left

Lateral view:

- Semi flexion of right knee
- Slight prominence of abdomen
- Flat back
- Semi flexion of both elbows
- Protraction of both shoulders

- Head in forward position

3.3.2 Gait Examination

The patient has been using crutches since the operation, and is still depending on them. M.M. is using forearm crutches. The patient is using the *Step Through* technique, meaning the injured leg (right) is placed between the crutches during the stance and the healthy leg in front. The Step Through technique includes weight bearing on the injured leg, and the patient puts 1/3 on the injured foot. The length of the step is rather short, the base of the feet's is normal and the speed is normal. The patient is fully independent while walking on the crutches. No assistance is needed, as there is minimal risk of falling. The patient is also educated on walking in stairs (good leg, crutches – good leg, crutches). The patient is fully independent on walking in stairs alone.

The patient is not able to walk on the heels.
The patient is not able to walk on the toes.
The patient is not able to walk in squat.

3.3.3 Range of Motion

Motion	Active Left	Active Right	Passive Left	Passive Right
Hip extension	15°	15°	10°	10°
Hip flexion	120°	120°	120°	120°
Range	135°	135°	130°	130°
Hip abduction	45°	45°	50°	50°
Hip adduction	10°	10°	10°	10°
Range	55°	55°	60°	60°
Hip lateral rotation	45°	45°	45°	45°
Hip medial rotation	45°	45°	45°	45°
Range	90°	90°	90°	90°
Knee flexion	140°	95°	140°	90°
Knee extension	0°	0°	0°	0°
Range	140°	95°	140°	90°
Plantar flexion	45°	40°	45°	45°
Dorsiflexion	20°	20°	20°	20°
Range	65°	60°	65°	65°
Inversion	40°	40°	40°	40°
Eversion	20°	20°	20°	20°
Range	60°	60°	60°	60°

Table 1: Showing range of motion in selected joints of the lower limbs in the initial kinesiological examination.

3.3.4 Neurological Examination

Deep tendon:

Reflex	Left	Right
Patellar (L2-4)	2	2
Achilles (S1-2)	2	2

Table 2: Showing deep tendon reflexes of the patella and achilles.

Superficial skin sensation: Dermatomes from the spinal segments L2-5 and S1 tested with normal and equal sensation on both sides.

Deep sensation movement: Normal

Babinski: Negative

Rhomberg 1: Negative
Rhomberg 2: Negative
Rhomberg 3: Negative

3.3.5 Joint Play Examination

Interphalangeal joints:

	1st left	**1st right**	**2nd left**	**2nd right**	**3rd left**	**3rd right**	**4th left**	**4th right**	**5th left**	**5th right**
Dorsal	No	No	No	No	No	No	No	No	No	No
Plantar	No	No	No	No	No	No	No	No	No	No
Lateral	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no
Rotation	No	No	No	No	No	No	No	No	No	No

Table 3: Showing joint play examination of the interphalangeal joint for the initial kinesiological examination.

Metacarpophalangeal joints:

	1st left	1st right	2nd left	2nd right	3rd left	3rd right	4th left	4th right	5th left	5th right
Dorsal	No	No	No	No	No	No	No	No	No	No
Plantar	No	No	No	No	No	No	No	No	No	No
Lateral	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no
Rotation	No	No	No	No	No	No	No	No	No	No

Table 4: Showing joint play examination of the metacarpophalangeal joint for the initial kinesiological examination.

Lisfranc joint:

	Left	**Right**
Dorsal	No	No
Plantar	No	No
Lateral	No/no	No/no
Rotation	No	No

Table 5: Showing joint play examination of the lisfranc joint for the initial kinesiological examination.

Talocrural joint:

	Left	**Right**
Lateral	No	No
Ventral	No	No
Dorsal	No	No

Table 6: Showing joint play examination of the talocrural joint for the initial kinesiological examination.

Tibiofibular joint:

	Left	**Right**
Ventral	No	Yes (with pain)
Dorsal	No	Yes (with pain)

Table 7: Showing joint play examination of the tibiofibular joint for the initial kinesiological examination.

Knee joint:

	Left	Right
Lateral	No	-*
Ventral	No	-*
Dorsal	No	-*

Table 8: Showing joint play examination of the knee joint for the initial kinesiological examination.

*Joint examination of the right knee joint was not performed on the patient because of the postoperative state.

3.3.6 Muscle Tonus

Muscle	Tonus Left	Pain Left	Tonus Right	Pain Right
Gluteus maximus	Normal	No	Normal	No
Tensor fascie latae	Normal	No	Normal	No
Adductor magnus	Normal	No	Normal	No
Rectus femoris	Normal	No	Hypertonus	No
Vastus lateralis	Normal	No	Hypertonus	No
Vastus medialis	Normal	No	Normal	No
Biceps femoris	Normal	No	Hypertonus	Yes*
Semitendinosus	Normal	No	Normal	No
Gastrocnemius	Normal	No	Hypertonus	Yes*
Tibialis anterior	Normal	No	Normal	No

Table 9: Showing muscle tonus for selected muscles for the initial kinesiological examination.

*Palpation is painful when muscle is stretched

3.3.7 Anthropometry

Length of limb

Length	Length Left	Length Right
Umbilicus – Medial malleolus	90 cm	90 cm
Anatomical length of lower limb	81 cm	81 cm
Functional length of lower limb	83 cm	83 cm

Table 10: Showing length of limb for the lower limbs, for the initial kinesiological examination.

Circumference

Circumference	Length Left	Length Right
Superior patella (+15 cm)	49 cm	51 cm
Patella	39,5 cm	43 cm
Inferior patella (-15 cm)	34,5 cm	34,5 cm

Table 11: Showing circumferences around the knee joint for the initial kinesiological examination.

3.3.8 Scale Test*

Scale test	Left side	Right side	Total
Weight	39 kg	31 kg	70 kg

Table 12: Showing results from the scale test for the initial kinesiological examination.

*The scale test was performed without crutches, and the patient was holding by the rib wall.

3.3.9 Basic Movement Patterns

Basic movement patterns	Left side	Right side
Hip abduction	Gluteals are the primal movement component, then tensor fascie latae and rectus femoris. Without pain.	Gluteals are the primal mover for the patient, then secondarily tensor fascie latae + rectus femoris and at last also erector are activated. Movement is performed without pain.
Hip extension	Correct movement pattern with activation of gluteus maximus first, biceps femoris on the ipsilateral side and then activation of the erector.	Same as left side. Slight pain during execution.

Table 13: Showing results from the basic movement patterns for the initial kinesiological examination.

3.3.10 Manual Muscle Test

Muscle	Left side	Right side
Gluteus maximus	4+	4+
Gluteus medius	4+	4+
Medial rotators of hip	4	4
Lateral rotators of hip	4	4
Hip adductors	4+	4+
Tensor fascie latae	4+	4
Sartorius	4	4+
Iliopsoas	4	4+
Quadriceps femoris	4+	4-*
Biceps femoris	4+	4-*
Semitendinosus/ Semimembranosus	4+	4
Gastrocnemius/ Plantaris	4	4
Tibialis anterior	5	4+
Tibialis posterior	5	4+

Table 14: Showing manual muscle test for selected muscles for the initial kinesiological examination.

*With pain

3.3.11 Muscle Length Test

	Left side	Right side
Gastrocnemius + Plantaris	No shortness	No shortness
Hamstrings	No shortness	Slight shortness
Hip flexors	No shortness	Shortness

Table 15: Showing muscle length test for selected muscles, for the initial kinesiological examination.

3.3.12 Examination's conclusion:

The initial kinesiological examination for the patient was performed on February the 1st 2012.

The patient has deviations in the posture, which can be seen as a connection of age, general physique (arthritis and coxarthritis together with the primary diagnosis) and the gonarthrosis with the TEP.

M.M is walking with crutches satisfactory, and no extra attention to this is necessary as the gait with the crutches is good. At the moment walking without crutches is out of the picture, so correction of the gait is not necessary.

ROM of the affected knee joint is the only joint which is decreased, and therefore the it should be a goal in the therapy to slowly increase it. And it is necessary to keep this progress slow, as exaggerating this soon after the operation can be dangerous.

The other findings that should be put attention to is the small increase in the circumference around the affected knee caused by the edema, and decreased muscle strength in muscles around the knee on the affected side. These muscles has to be strengthened in the long term. The examination also revealed what seems to be shortness of the hip flexors, but this can also be related to restriction in the joint, and should therefore be taken carefully.

The joint play examination showed no almost no restriction in any joint of the lower extremities, except the tibiofibular joint on the operated side, where there was both restriction and pain in the joint during the examination.

3.4 Long-term and short-term plan:

The short-term plan should be focused on decreasing the slight pains the patient is experiencing, and the circumference around the knee joint connected to the edema. The long-term plan should be focused on increasing ROM in the knee joint, and increase muscle strength in muscles around the knee joint to prepare the patient for a normal life again. These two should also be included in the short-term plan. When the knee is ready for it and the patient no longer is in the need or crutches, the focus should be on improving the gait, as the gait without crutches is expected to be poor.

Short-term plan:

- Decrease pain by thermotherapy (not available)
- Relaxation of shortened muscles (biceps femoris and quadriceps) by PIR

- Soft tissue techniques according to Lewit to increase fascia mobility
- Non-invasive Strengthening exercises in bed (rather than standing) of weak muscles (biceps femoris, hip adductors, quadriceps) through eccentric and concentric exercises
- Increase range of motion in the knee joint (flexion)
- Improve gait and stability while walking with crutches

Long-term plan:

- Strengthening of weak muscles (biceps femoris, hip adductors, quadriceps) through eccentric and concentric exercises to equal muscle imbalance
- Increase range of motion in the knee joint (flexion)
- Improved gait for independent walking
- Hiking in easy terrain with sticks for balance support and less force on both knees
- Sensomotoric training

3.5 Therapy progress

3.5.1 Date: 01.02.12

Goal of today's therapy unit:

- Perform initial kinesiologic examination
- Decrease muscular pain in the knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength according to findings in kinesiological examination

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold

- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation for biceps femoris and quadriceps.
- Strength:
    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 3 sets, 10 repetitions.
    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 3 sets, 10 repetitions. Alternatively ball is placed under the ankle joint.
    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 2 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.

Results:

The pain is according to the patient 1/10 (VAS) while the patient is relaxed on the therapy table, and increases slightly during increased joint range, and at maximum flexion the pain is about 4/10 according to the patient. Being the first therapy session, improvements cannot be traced, but the patient is able to perform all exercises without being in too much pain.

Self-therapy:

- Continuous passive flexion and extension of the knee joint with CPM device (Continuous Passive Motion) following after the therapy session in the patient's room. Duration is 30 minutes, knee extension is set to full (0°) and knee flexion is set to 90°.
- Walking in the corridor to improve the gait and activate the artificial knee joint.
- Thromboembolic prevention for the lower extremities while in bed.

3.5.2 Date: 02.02.12

Goal of today's therapy unit:

- Decrease muscular pain in knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength of biceps femoris and rectus femoris/quadriceps

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold
- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation of biceps femoris and quadriceps.
- Post isometric relaxation of gastrocnemius
- Post isometric relaxation of triceps surae
- Strength:
    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 3 sets, 10 repetitions.
    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 3 sets, 10 repetitions. Alternatively ball is placed under the ankle joint.
    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 2 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.

Results: The state of the patient is the same as it was yesterday. The knee pain during flexion is the same, and edema is on the same level and the range of motion and the strength is the same. The patient complains about tension in the triceps surae during maximal knee extension, and PIR is therefore applied.

Self-therapy: Same as 01.02.12.

3.5.3 Date: 03.02.12

Goal of today's therapy unit:

- Decrease muscular pain in knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength of biceps femoris and rectus femoris/quadriceps

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold
- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation of biceps femoris and quadriceps.
- Post isometric relaxation of triceps surae.
- Strength:
    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 3 sets, 10 repetitions.
    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 3 sets, 10 repetitions. Alternatively ball is placed under the ankle joint.

    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 2 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.

Results: The patient complains about slight pain in the triceps surae, and PIR is therefore applied to it. The patient seems to be in the same state as during the previous sessions.

Self-therapy: Same as 01.02.12.

3.5.4 Date: 06.02.12

Goal of today's therapy unit:

- Decrease muscular pain in knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength of biceps femoris and rectus femoris/quadriceps

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold
- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation of biceps femoris and quadriceps.
- Strength:
    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 3 sets, 10 repetitions.

    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 3 sets, 10 repetitions. Alternatively ball is placed under the ankle joint.
    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 2 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.

Results: The patient seems to be increasing the flexion of the knee more than the first week. The patient agrees, and says that the pain during the sessions are decreasing slightly as well.

Self-therapy: Same as 01.02.12.

3.5.5 Date: 07.02.12

Goal of today's therapy unit:

- Decrease muscular pain in knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength of biceps femoris and rectus femoris/quadriceps

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold
- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation of biceps femoris and quadriceps.
- Strength:

    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 4 sets, 12 repetitions.
    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 4 sets, 12 repetitions. Alternatively ball is placed under the ankle joint.
    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 3 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.

Results: The patient clearly has had some improvements and the patient is able to adapt to a slight increase in the workload. Improvements can be seen in most problematic areas. The angle on the flexion-extension machine has also been increased slightly.

Self-therapy: Same as 01.02.12.

3.5.6 Date: 08.02.12

Goal of today's therapy unit:

- Decrease muscular pain in knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength of biceps femoris and rectus femoris/quadriceps

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold

- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation of biceps femoris and quadriceps.
- Strength:
    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 4 sets, 12 repetitions.
    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 4 sets, 12 repetitions. Alternatively ball is placed under the ankle joint.
    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 3 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.

Results: The patient is in good shape and almost free of pain, only slight pain at the end point of some of the exercises.

Self-therapy: Same as 01.02.12.

3.5.7 Date: 09.02.12

Goal of today's therapy unit:

- Decrease muscular pain in knee area
- Decrease edema
- Increase range of motion in knee joint
- Increase strength of biceps femoris and rectus femoris/quadriceps

Procedure:

- Soft tissue scar therapy, by kneading and palpation-rolling transversal and longitudinally. Patient is in supine position on the therapy table
- Passive motion of the affected knee into flexion and extension up to the pain threshold
- Mobilization for tibiofibular joint in dorsal and ventral direction on the right side
- Post isometric relaxation of biceps femoris and quadriceps.
- Strength:
    - Hip and knee in 90° flexion, and patient extends hip and knee against therapists resistance by eccentric contraction (for quadriceps) – 4 sets, 12 repetitions.
    - Hip and knee straight, patient is lying supine with a rubber ball under the knee, and the patient presses on the ball by isometric contraction of the biceps femoris. 4 sets, 12 repetitions. Alternatively ball is placed under the ankle joint.
    - Patient in prone position, with hip and knee extended. Against therapists resistance, patient flexes the knee by concentric contraction, followed by extension of the knee against resistance by eccentric contraction. 3 sets, 10 repetitions.
- Sensomotoric training: Patient places affected lower limb on an airpad and increase the force, and relax. Repeated for about 3 minutes.
- Final kinesiological examination.

Results: The pain level is the same as the session yesterday. The patient seems optimistic and eager in the treatment. Todays session was a little longer because of the final kinesiological examination.

Self-therapy: Same as 01.02.12.

3.6 Final kinesiological examination

3.6.1 Postural Examination

Anterior view:

- Halux valgus of right foot
- Over pronating especially on the right lower limb
- Flat feet on both sides/decreased arch
- Slight edema of right knee joint
- Patella on left the left side seems lower than center of right knee joint
- Anterior superior iliac spine lower on the right side than left
- Left shoulder more elevated than right

Posterior view:

- Posterior superior iliac spine lower on the right side than the left
- Winged scapula's
- Left shoulder more elevated than right

Lateral view:

- Semi flexion of right knee
- Slight prominence of abdomen
- Flat back
- Semi flexion of both elbows
- Protraction of both shoulders
- Head in forward position

3.6.2 Gait Examination

The patient is still using forearm crutches, and walking with the *Step Through* technique. The length of the step is still rather short, and the base of the feet's and the speed is normal.

The patient is somewhat able to walk on the heels.

The patient is somewhat able to walk on the toes.

The patient is not able to walk in squat.

3.6.3 Range of Motion

Motion	Active Left	Active Right	Passive Left	Passive Right
Hip extension	15°	15°	10°	15°
Hip flexion	120°	120°	120°	120°
Range	135°	135°	130°	135°
Hip abduction	45°	45°	50°	50°
Hip adduction	10°	10°	10°	10°
Range	55°	55°	60°	60°
Hip lateral rotation	45°	45°	45°	45°
Hip medial rotation	45°	45°	45°	45°
Range	90°	90°	90°	90°
Knee flexion	140°	105°	140°	110°
Knee extension	0°	0°	0°	0°
Range	140°	105°	140°	110°
Plantar flexion	45°	45°	45°	45°
Dorsiflexion	20°	20°	20°	20°
Range	65°	65°	65°	65°
Inversion	40°	40°	40°	40°
Eversion	20°	20°	20°	20°
Range	60°	60°	60°	60°

Table 16: Showing range of motion in selected joints of the lower limbs in the final kinesiological examination.

3.6.4 Neurological Examination

Deep tendon:

Reflex	Left	Right
Patellar (L2-4)	2	2
Achilles (S1-2)	2	2

Table 17: Showing deep tendon reflexes of the patella and achilles.

Superficial skin sensation: Dermatomes from the spinal segments L2-5 and S1 tested with normal and equal sensation on both sides.

Deep sensation movement: Normal

Babinski: Negative

Rhomberg: Negative

3.6.5 Joint Play Examination

Interphalangeal joints:

	1st left	1st right	2nd left	2nd right	3rd left	3rd right	4th left	4th right	5th left	5th right
Dorsal	No	No	No	No	No	No	No	No	No	No
Plantar	No	No	No	No	No	No	No	No	No	No
Lateral	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no
Rotation	No	No	No	No	No	No	No	No	No	No

Table 18: Showing joint play examination of the interphalangeal joint for the final kinesiological examination.

Metacarpophalangeal joints:

	1st left	1st right	2nd left	2nd right	3rd left	3rd right	4th left	4th right	5th left	5th right
Dorsal	No	No	No	No	No	No	No	No	No	No
Plantar	No	No	No	No	No	No	No	No	No	No
Lateral	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no	No/ no
Rotation	No	No	No	No	No	No	No	No	No	No

Table 19: Showing joint play examination of the metacarpophalangeal joint for the final kinesiological examination.

Lisfranc joint:

	Left	**Right**
Dorsal	No	No
Plantar	No	No
Lateral	No/no	No/no
Rotation	No	No

Table 20: Showing joint play examination of the lisfranc joint for the final kinesiological examination.

Talocrural joint:

	Left	**Right**
Lateral	No	No
Ventral	No	No
Dorsal	No	No

Table 21: Showing joint play examination of the talocrural joint for the final kinesiological examination.

Tibiofibular joint:

	Left	**Right**
Ventral	No	Yes (with pain)
Dorsal	No	Yes (with pain)

Table 22: Showing joint play examination of the tibiofibular joint for the final kinesiological examination.

Knee joint:

	Left	Right
Lateral	No	-*
Ventral	No	-*
Dorsal	No	-*

Table 23: Showing joint play examination of the knee joint for the final kinesiological examination.

*Joint examination of the right knee joint was not performed on the patient because of the postoperative state.

3.6.6 Muscle Tonus

Muscle	Tonus Left	Pain Left	Tonus Right	Pain Right
Gluteus maximus	Normal	No	Normal	No
Tensor fascie latae	Normal	No	Normal	No
Adductor magnus	Normal	No	Normal	No
Rectus femoris	Normal	No	Normal	No
Vastus lateralis	Normal	No	Normal	No
Vastus medialis	Normal	No	Normal	No
Biceps femoris	Normal	No	Hypertonus	Yes*
Semitendinosus	Normal	No	Normal	No
Gastrocnemius	Normal	No	Hypertonus	Yes*
Tibialis anterior	Normal	No	Normal	No

Table 24: Showing muscle tonus for selected muscles for the final kinesiological examination.

*Palpation is painful when muscle is stretched

3.6.7 Anthropometry

Length of limb

Length	Length Left	Length Right
Umbilicus – Medial malleolus	90 cm	90 cm
Anatomical length of lower limb	81 cm	81 cm
Functional length of lower limb	83 cm	83 cm

Table 25: Showing length of limb for the lower limbs, for the initial kinesiological examination.

Circumference

Circumference	Length Left	Length Right
Superior patella (+15 cm)	49 cm	51 cm
Patella	39,5 cm	41 cm
Inferior patella (-15 cm)	34 cm	34 cm

Table 26: Showing circumferences around the knee joint for the final kinesiological examination.

3.6.8 Scale Test

Scale test	Left side	Right side	Total
Weight	38 kg	31 kg	69 kg

Table 27: Showing results from the scale test for the final kinesiological examination.

3.6.9 Basic Movement Patterns

Basic movement patterns	Left side	Right side
Hip abduction	Gluteals are the primal movement component, then tensor fascie latae and rectus femoris. Without pain.*	Gluteals are the primal mover for the patient, then secondarily tensor fascie latae + rectus femoris and at last also erector are activated. Movement is performed without pain.*
Hip extension	Correct movement pattern with activation of gluteus maximus first, biceps femoris on the ipsilateral side and then activation of the erector. *	Same as left side. Still light pain during execution, but less than in the initial test.

Table 28: Showing results from the basic movement patterns for the final kinesiological examination.

*Seems to be the same as in the initial kinesiological examination

3.6.10 Manual Muscle Test

Muscle	Left side	Right side
Gluteus maximus	4+	4+
Gluteus medius	4+	4+
Medial rotators of hip	4+	4+
Lateral rotators of hip	4+	4+
Hip adductors	4+	4+
Tensor fascie latae	4+	4
Sartorius	4	4+
Iliopsoas	4	4+
Quadriceps femoris	4+	4-*
Biceps femoris	4+	4
Semitendinosus/ Semimembranosus	4+	4+
Gastrocnemius/ Plantaris	4	4+
Tibialis anterior	5	5
Tibialis posterior	5	5

Table 29: Showing manual muscle test for selected muscles for the final kinesiological examination.

*With pain

3.6.11 Muscle Length Test

	Left side	Right side
Gastrocnemius + Plantaris	No shortness	No shortness
Hamstrings	No shortness	No shortness
Hip flexors	No shortness	Shortness

Table 30: Showing muscle length test for selected muscles, for the final kinesiological examination.

3.6.12 Examination's conclusion:

The final kinesiological examination was performed on the patient on February the 9th 2012.

Most of the parameters that wasn't put attention to during the treatment was unchanged from the initial kinesiological examination to the final kinesiological examination, so the main focus is on the parameters that wasn't satisfactory in the initial kinesiological examination.

The ROM of knee joint flexion was decreased in the initial examination, and was still decreased after the final examination, however the ROM had increased a lot. To expect that the development will continue like that in that speed would be optimistic, but it is clear that there have been some great improvements connected to the ROM of the patient.

The parameters also revealed increase in muscle strength, especially in the knee flexors, which is satisfactory, and the fact that there is less pain connected to it is also showing that there is a good progression.

The circumferences on and around the right knee joint, connected to the edema has also decreased slightly. The patient has obviously recently had a major operation and the structure of the knee is changed, so expecting that the circumference would be the same in both knees would be too optimistic, so the progression that has been is therefore good.

3.7 Evaluation of the effects of the therapy

Through the rather few therapy sessions the patient underwent, changes in the patients state was noticeable, which was expected, as the patient recently had the operation but on the same time was in an important time of the postoperative period, as improvements happened fast.

The main focus of the therapy was pain, the edema, ROM and muscle strength. All of these improved, whereas the most noticeable change was in the ROM where the knee flexion increased with 10% of the affected right knee, comparing the results from the initial and the final kinesiological examination. The patient also

showed improvements in muscle strength, which is important in order to make the patient able to walk without aids again as soon as possible. Some of the pain connected to knee flexion is no longer present.

The fact that the therapy was rather one-sided, with almost the same exercises from day to day could possibly have contributed to the results, but for future therapy more variations might be needed in order to prepare the body of ADL.

Something as easy as passive movements seemed to be very beneficial, and much of the stiffness that was present in the joint went away because of this. Of course, this was achieved accompanying other techniques with similar effects, such as PIR.

4. CONCLUSION

At times, barriers during the treatment connected to age, the fact that M.M and I didn't have the same native language and the patients, at times, disbelief in herself could have been disadvantageous to the further development. But a good dialogue, the patients wish to be able to take care of herself and a fitted therapeutic plan contributed to great achievements during a rather short period of time.

The patient did suffer from other developing degenerative changes in the body, though not that severe at the time, but what in the future possibly could lead to further operations. The fact that I was instructed to focus on only one area and that the pains of the patient was relatively small, made it possible to achieve what was achieved. The short amount of therapy sessions makes it difficult to determine how the prospect of the objects of the patients long-term plan would be achieved at its full, but the patient did show progress related to range of motion and muscle strength, which was both a part of the short- and the long-term plan. That, and in terms of pain from the short-term plan, showed that goals was achieved.

The new experience related to real patients treated on my own, like running on a tight schedule and maintaining a speed during the therapy sessions as there were many patients who deserved the same amount of attention as the case study was of great value, as certain things cannot be learned just from a lecture, it has to be experienced.

Looking at the case study again, it gave light to the fact that a concrete diagnosis doesn't necessarily mean that you can look up in a book and find out exactly what you need to do. Every patient needs to be respected for who he or she is as everyone is different and will react in his or her own way to the treatment. On the other hand, having a concrete diagnosis is interesting for the physiotherapist, as the foundation of the knowledge is there, and when you don't need to hesitate on what to do, and when the focus is on the same things, the development of the patient will show.

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6. APPENDIX

6.1 Approval of the ethics board committee

CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
José Martího 31, 162 52 Praha 6-Veleslavín
tel. +420 2 2017 1111
http://www.ftvs.cuni.cz/

Application for Ethics Board Review

of the research project, doctoral research, master degree research, undergraduate research, involving human subjects

Project title: Gonarthrosis (arthrosis of the knee joint)

Nature of the research project: master degree research / undergraduate research

Author (chief investigator): Eirik Tempelhaug

Supervisor (in case of student research): Mgr. Lenka Satrapová

Research project description also involves Case Study of physiotherapy treatment of a patient with the diagnosis of gonarthrosis will be conducted under the expert supervision of an experienced physiotherapist at Revmatologický Ústav.
Guaranteed safety to be judged by experts: No invasive methods will be used.
Ethical aspects of the research:
Personal data obtained during the investigation will not be published.
Informed consent (attached)

Date: Author's signature:

Faculty of Physical Education and Sport, Charles University in Prague
ETHICS BOARD REVIEW

Ethics Board members: Doc. MUDr. Staša Bartůňková, CSc.
Prof. Ing. Václav Bunc, CSc.
Prof. PhDr. Pavel Slepička, DrSc.
Doc. MUDr. Jan Heller, CSc.

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, approved the research project.
Approval number: 066/2012
Date: 17.2.2012

The Ethics Board at the Faculty of Physical Education and Sport, Charles University, reviewed the submitted research project and **found no contradictions with valid principles**, regulations and international guidelines for biomedical research involving human subjects.

The chief investigator of the project met the necessary requirements for receiving the Ethics Board approval.

Official school stamp
UNIVERZITA KARLOVA v Praze
Fakulta tělesné výchovy a sportu
José Martího 31, 162 52, Praha 6
1

Signature, REB Chairman

6.2 Informed consent/Informovaný souhlas

V souladu se Zákonem o péči o zdraví lidu (§ 23 odst. 2 zákona č.20/1966 Sb.) a Úmluvou o lidských právech a biomedicíně č. 96/2001, Vás žádám o souhlas kvyšetření a následné terapii. Dále Vás žádám o souhlas knahlížení do Vaší dokumentace osobou získávající způsobilost k výkonu zdravotnického povolání v rámci praktické výuky a s uveřejněním výsledků terapie v rámci bakalářské práce na FTVS UK. Osobní data v této studii nebudou uvedena.

Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl.

Prohlašuji, že jsem shora uvedenému poučení plně porozuměla a výslovně souhlasím s provedením vyšetření a následnou terapií. Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum:.....

Osoba, která provedla poučení:.....

Podpis osoby, která provedla poučení:.....

Vlastnoruční podpis pacienta /tky:.....

6.3 List of abbreviation

ACL – anterior cruciate ligament

PCL – posterior cruciate ligament

MCL – medial crucial ligament

LCL – lateral crucial ligament

L – lumbar

S – sacrum

MRI – magnetic resonance imaging

MHC – major histocompability complex

ROM – range of motion

ADL – activities of daily living

NSAID – non-steroidal anti-inflammatory drug

TKA – total knee arthroplasty

TEP – total endo-prosthesis

UVN - Ústřední vojenské nemocnice

PIR – post isometric relaxation

TENS – Transcutaneous electrical stimulation

EMS – Electrical muscle stimulation

6.4 List of illustrations

Pictures:

List of tables: