

CHARLES UNIVERSITY IN PRAGUE
Faculty of Physical Education and Sport

Gonarthrosis and total knee replacement

Bachelor thesis

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Abstract

Title: Gonarthrosis and total knee replacement

The knee is the largest joint in the body. There are some degenerative diseases that can attack the joints. This thesis is about gonarthrosis and total knee replacement. Total knee replacement is one of the most common surgeries around the world. It is mainly caused by degeneration of the cartilage in the knee joint. Age plays a big role influencing this. This degeneration can lead to gonarthrosis, which simply, arthrosis of the knee. Main symptoms include joint pain, stiffness, tenderness and inflammation of the joint. The problem can be treated conservatively when is not severe and surgically when is severe.

Key words: Total knee replacement, gonarthrosis, total knee arthroplasty, cartilage, inflammation.

Dedictory

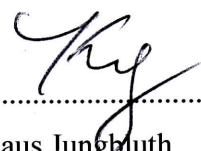
I would like to dedicate this bachelor's thesis to my two daughters Kiersten and Melina, my parents, my sister and all my friends and persons who helped me and supported me for the accomplishment of this work. Thank you all.

ACKNOWLEDGMENT

I had the opportunity to have my bachelor case study two week practice in CLPA Prague, there I met my patient which had a total knee replacement in his left knee. I would like to thank him, because it was a great experience to work with him and see how the therapies provide healing and recovery for him. I would like to thank PhDr. Michaela Prokešová, Ph.D for her time, help and guidance through this bachelor thesis, also I would like special thanks to my supervisor at CLPA PhDr. Edwin Mahr, Ph.D.

Declaration

I declare that this bachelor thesis is based on my own individual research during my period of clinical practice at CLPA in Vysocany, Prague, between the 9th and the 20th of February of 2009.



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Klaus Jungbluth

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LIST OF ABBREVIATIONS

CLPA Centrum leczy polyboveho aparatu
ACL Anterior cruciate ligament
PCL Posterior cruciate ligament
LCL Laterocollateral ligament
MCL Medial collateral ligament
TKR Total Knee Replacement
ROM. Range of motion
TKA Total knee arthroplasty
CPM Continuous passive motion
BMI Body mass index
UE Upper extremity
LE Lower extremity
R Right
L Left
IP Interphalangeal
MT Metatarzal
MTP Metatarzophalangeal
MMSE Mini mental state examination
ADL Activities of daily living
SIAS Spina Iliaca anterior superior
SI Sacro iliac
PIR Post isometric relaxation
PNF Proprioceptive neuromuscular facilitation
LS Lumbo sacral

1. INTRODUCTION

I was given a patient that had a Total knee replacement surgery due to gonarthrosis, at a my clinical work placement in CLPA Prague. The clinical work placement was from 09.02.2009 to 20.02.2009. I had the chance to give the patient ten sessions of therapy.

The main objectives of this thesis are, the description of the knee joint and gonarthrosis, followed by the description of the case study with my patient, where anamnesis, physical examinations as well ad treatment proposals for the patient were performed.

2. Theoretical part

2.1. Anatomy of the knee joint

The biggest joint in the body, the knee joint is formed where the lower part of the thighbone (femur) joins the upper part of the shinbone (tibia) and the kneecap (patella). Shock-absorbing cartilage covers the surfaces where these three bones touch. In a normal knee, the bone surfaces that come together at the joint-thighbone, shinbone and kneecap-- are smooth and hard. A cushioning layer of tissue (cartilage) prevents direct contact between these bones. When the cartilage is damaged, these bones rub together, causing friction, pain and, eventually, deterioration of the bone surfaces. (2)

As it is the largest joint in the body, it is also prone to pain and loss of function and stability, which requires surgery. The knee is the middle joint of the lower extremity, it is formed by two other articulations, the femoropatellar which is a trochlear and the femorotibial, which is a bycondial. Although the tibia and the patella do not articulate with each other.

The knee has two ranges of motion, flexion – extension, and internal rotation and external rotation. It has two cartilages meniscus that bind to the tibia by the anterior and posterior sides and on the lateral side they are binded by the joint capsule. (4)

The bones that make the knee joint are femur, tibia, fibula and patella.

The femur, or thigh bone, is the longest bone in the human body. At the bottom of the shaft, the bone widens at the point where it articulates with the lower leg bone (the tibia). The medial and lateral epicondyles are the part of the femur that sit on top of the tibia. The tibia, or lower leg bone, is also one of the longest bones in the body. Working our way up the shaft of the tibia, we end up at the wider tibial plateau, which is the part that articulates with the femur. Three of the four main ligaments that provide stability to the knee connect the femur to the tibia. The fibula is the long bone of the lower leg that sits to the lateral side of the tibia. It is significant because it is the distal attachment site of the lateral collateral ligament. The patella, or kneecap, is a small sesamoid bone surrounded by connective tissue. The patella slides through the trochlear groove on the femur during leg flexion and extension. (7)

The knee has 4 main ligaments which connect bone to bone and are made of fibrous connective tissue, which control certain motions of the joint. The Anterior Cruciate

Ligament (ACL) stabilizes the knee and minimizes stress across the knee joint. The ACL is located in the center of the knee, and prevents the tibia from moving forward on the femur. It checks external rotation of the tibia in flexion and to a degree checks hyperextension of the knee. It has 2 portions or bundles; the anterior medial and the posterolateral. The ant med bundle is tight in both flexion and extension, while the posterolateral is tight only upon extension. The least stress is placed on the ligament when the knee is positioned between 30 and 60 degrees of flexion. (2)

The Posterior Cruciate Ligament (PCL) is located in the center of the knee and crosses behind the ACL. The PCL prevents backward translation of the tibia on the femur, (PCL) is a strong fan shaped ligament that is the strongest in the body. It is the primary stabilizer against posterior movement of the tibia on the femur and it helps check the knee in extension. It also functions as the central axis of rotation and helps the ACL guide the knee into the screw home position.

The Lateral Collateral Ligament (LCL) is located on the outer (lateral) aspect of the knee; it is attached proximally to the lateral femoral epicondyle and distally to the head of the fibula. The LCL helps resist varus motion (outward bowing) of the knee. The Medial Collateral Ligament (MCL) is located on the inner (medial) aspect of the knee; it connects the femur to the tibia on the medial side of the knee. The MCL helps resist valgus motion (inward bowing, knock-knee) of the knee. The secondary ligaments are, the coronary, transverse, and the ligament of Wrisberg attach the meniscus together and tie them down. The popliteal ligament has two portions, oblique and arcuate portions, along with the tendons of the semimembranosus provide added posterior support of the knee joint.

The Meniscus provide stability to the knee joint, The Medial Meniscus is shaped like the letter "C" and is attached to the MCL. The medial meniscus provides stability and acts as a shock absorber for the knee. The Lateral Meniscus is shaped like the letter "O" and also provides added stability and cushion for the knee. The Meniscus have certain functions like:

- A. Lubrication
- B. Nutrition
- C. Shock absorbers
- D. Spread stress

- E. Decrease articular cartilage wear
- F. Make joint spaces more congruent
- G. Prevent hyperextension

The menisci possess no nerves, thus there is no pain unless a coronary ligament has been damaged. There is seldom a bloody effusion, however, you might find synovial swelling.

(2)

Articular Cartilage is another type of cartilage that lines the surface of bones where they articulate with other bones. In the knee, articular cartilage covers the femoral condyles, the tibial plateau, and the posterior (back) portion of the patella. Tendons work in conjunction with the ligaments to move the knee through natural flexion and extension. They are comprised of strong strings of tissue that connect muscles to bones. Tendons of the knee include the quadriceps tendon, which connects the quadriceps muscle to the patella, and the patellar tendon, which is the end part of the quadriceps tendon. The patellar tendon attaches to the front of the tibia. (4)

The muscles that conform the knee joint or are related to it are: Quadriceps, Vastus lateralis, Vastus intermedius, Vastus femoris, Vastus medialis; Hamstrings, Semimembranosus, Semitendinosus, Biceps femoris; Calf muscles, Gastrocnemius, Soleus, Popliteus. Pes Anserine muscle attachment is into the medial tibia. It consists of the sartorius semitendinosus and gracilis. (8)

Bursae. Bursae are water-filled sacs which provide a cushioning and a lubricating effect for soft tissues over bone. Anterior: Prepatellar bursae which lies between the patella and skin. Infrapatellar bursae between the tibia and patella ligament. Medial: Lies between the head of gastrocnemius and the articular capsule. Under the Pes Anserine and between the medial collateral ligament and the muscles and the muscles and skin.

Lateral: Lies between the lateral collateral ligament and the biceps femoris muscle. There are more than 18 separate bursae in and around the knee.

Kinesiology of knee motion:

Flexion: 130-140 degrees; This movement is executed by the biceps femoris, semitendinous, semimembranosus, gracilis, sartorius, gastrocnemius, popliteus, and plantaris.

Extension: 0 degrees; This movement is executed by the quadriceps group consisting of the vastus medialis, vastus lateralis, vastus intermedius, and the rectus femoris.

Internal rotation: 10 degrees - Controlled by the semimembranosus, sartorius, and gracilis.

External rotation: 10 degrees - Controlled by the biceps femoris.

Rotation of the tibia is limited and can only occur when knee is flexed. Several things occur to the knee structures as the joint is flexed, extended, or rotated.

Rotation is the partial result of the greater length of the medial condyle of the femur which rolls forward more than the lateral. The medial meniscus becomes distorted during this twisting due to the tibial attachment.

At the time of full extension, the lateral condyle of the femur becomes "set" on the tibia, while the medial condyle continues forward to a position of slight external rotation. This final movement is referred to as the screw home movement. The final muscles responsible for this motion are the vastus medialis oblique which extends the knee, but the popliteus muscle rotates the tibia to complete the screw home action. (2)

2.2. Kinesiology and biomechanics of the Knee

Active movements of the knee joint are flexion, extension, internal and external rotation, and small passive movements which are important for correct function of the joint. Basic position of the knee joint is full extension. From this position is possible to go into the hyperextension, where this hyperextension could go from 5 to 15 degrees due to the elasticity of the joint. The opposite movement is the flexion, it can go up to 140 degrees, this movement can depend on factors that can limit the full range of motion. Maximal active flexion could be increased passively by around 20 degrees, for example on a squat position, the body weights pushes down and increases the flexion.

Flexion and extension are performed on the sagittal plane.

The ligaments of the knee play a big role on the knee biomechanics, they resist and limit the extension. The (MCL) Medial collateral ligament put resistance on the valgosity strength force and the (LCL) Latero Collateral Ligament put resistance on the varosity strength force. During knee extension the tibia glides anteriorly on the femur and the femur glides posteriorly on the tibia, while during knee flexion the tibia glides posteriorly on the femur and the femur glides anteriorly on the tibia.

From 20 degrees knee flexion to full extension the tibia rotates externally and the femur rotates internally on a stable tibia, while from full knee extension to 20 degrees flexion the tibia rotates internally and the femur rotates externally on a stable tibia. (13)

2.3. Gonarthrosis

Advanced osteoarthritis is the most common cause for total knee replacement. It is also an important reason for consulting the general practitioner in older adults. It is believed that the reason for getting osteoarthritis is a combination of several factors and that it is not caused by one entity alone. In the knee of a normal healthy person the surfaces of the knee joint is covered with articular cartilage. This cartilage works as a shock absorber. It does also provide low friction between the components of the knee. In an arthritic knee the articular cartilage is either worn or torn away. When this happens the patient often experiences pain and problems in performing normal activities of daily living. These problems associated with osteoarthritis will reduce the quality of life of the patients and it might also increase the risk for other sickness related problems and some times even result in death. (2)

There are two normal ways of assessing osteoarthritis of the knee. Firstly it is the standard diagnostic way where the specialist defines the severity and the extent of the problem by the help of a thorough medical interview and a clinical examination. Secondly it is the radiographic investigation by X-ray and arthroscopy. The classification criteria which are used for osteoarthritis of the knee are as following: Pain in the knee and the finding of osteophytes in radiographic tests or pain in the knee and an age of more than or equal to 40 years and morning stiffness less than or equal to 30min in duration and motion crepitus.

Conservative treatment of osteoarthritis should normally be tried before a TKR is performed. Treatment of osteoarthritis of the knee normally consists of three types of therapy: nonpharmacological, pharmacological and invasive interventions. Firstly the nonpharmacological treatment might contain such things as: physiotherapy, health promotion, patient education, home exercise programs and lifestyle changes (1)

Secondly the pharmacological treatment might consist of treatment with NSAIDs, paracetamol, medications applied directly to the skin and opioid- or non-opioid analgesia.

Last the invasive interventions mainly focus on intra-articular injections, lavage and joint replacement (4).

There are few absolute contraindications for TKR other than active local or systemic infection and other medical conditions that substantially increase the risk of serious perioperative complications or death. Obesity is not a contraindication to TKR; however, there may be an increased risk of delayed wound healing and perioperative infection in obese patients. Severe peripheral vascular disease and some neurologic impairments are both relative contraindications to TKR. (7)

2.4. Statistics

The average age for a total knee replacement is 70. Osteoarthritis, one of the four most common problems linked to obesity, is the major cause of surgery. Overweight and obese people are 24 per cent more likely to require knee surgery. There are more replacement operations performed on the knee than any other joint in the body: more than 600 000 total knee replacements are performed each year globally. The annual total global knee market is estimated to be worth 2 billion dollars. (11)

Preoperative complications as defined by the investigator occurred in 5.4 percent of patients and 7.6 percent of knees. Most of these complications were "knee related" or deep venous thrombosis. There were only eight cardiovascular or pulmonary complications reported among nearly 6,000 patients.

A well-executed total knee replacement can last up to 15 years (95% predicted survival of the implant). Still, the operation and recovery can be difficult.

Each year, approximately 300,000 TKR surgeries are performed in the United States for end-stage arthritis of the knee joint. As the number of TKR surgeries performed each year increases and the indications for TKR extend to younger as well as older patients, a review of available scientific information is necessary to enhance clinical decision-making and stimulate further research. (9)

First used in the late 1950s, early TKR implants poorly mimicked the natural motion of the knee and resulted in high failure and complication rates. Advances in TKR

technology in the past 10 years have enhanced the design and fit of knee implants, resulting in improved short- and long-term outcomes.

A recent study of Medicare administrative data from 1998 through 2000 revealed annual procedure rates per 1,000 of 4.8 for white males, 3.5 for Hispanic males, and 1.9 for African American males. The corresponding rates were 5.9 for white women, 5.4 for Hispanic women, and 4.8 for African American women. (11)

2.5. Total Knee Replacement

There are actually three reasons the doctor (an orthopedic surgeon) will recommend an artificial knee. These are: 1) to relieve pain 2) to restore function and 3) to achieve stability. As the affected knee becomes more painful, the patient will use it less. Function, therefore, is lost. As the arthritic knee continues to deform, the patient will feel that the joint is unstable.

The most common indication for total knee replacement is osteoarthritis, or degenerative joint disease. The end stage of osteoarthritis is wearing out of cartilage (smooth, gliding bone ends) resulting in bone-to-bone contact in diseased joints. It is progressive and becomes increasingly painful as the cartilage erodes. Younger people who get knee replacements have damaged their joints by trauma (accidents that destroy joint surfaces), infection, cancer or tumor, or inflammatory conditions as rheumatoid arthritis.

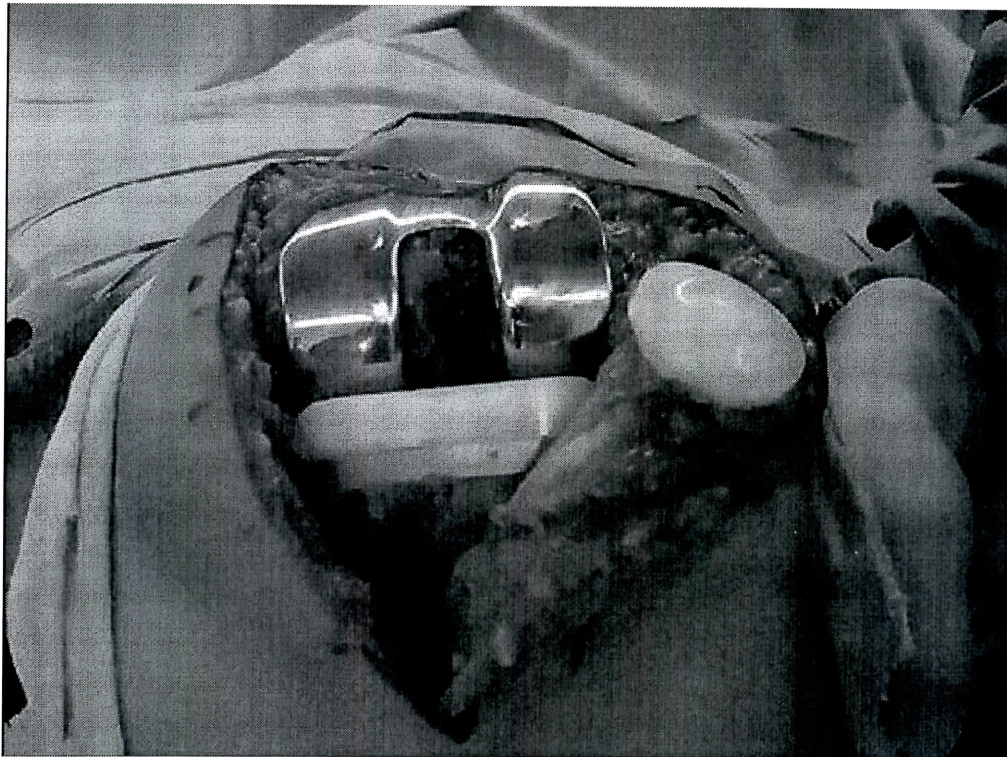
Like any surgery, knee joint replacement carries certain life-threatening risks, such as infection, blood clots and complications from anesthesia. Other complications include nerve damage, dislocation of breakage after surgery, and wearing out or loosening of the joint over time (3).

The patients can normally choose between two types of anaesthesia when they go through an operation (spinal anaesthesia or epidural anaesthesia). Spinal anaesthesia is however the most commonly used for patients undergoing total knee replacement surgery. The first thing that the surgeon will do is to make a midline incision alongside of the patella to surgically expose the joint. The incision is made under tourniquet control. Once the joint is fully exposed he or she will start working on cutting the bones so that the prosthesis parts will fit perfectly. The surgeon will normally start working on the head of femur and then move on to cutting the tibia (6).

The midline incision is according to the University of Washington (2006) normally 20 to 25cm in traditional total knee replacement. When the bones are properly cut and adjusted to the parts, the prosthesis will be cemented into place using special bone cement (about 97% of all TKRs in United States in 2004 had cement as a fixation technique according to the American Arthroplasty Register (2006)).(10)

The surgeon often uses a technique where he releases the tourniquet before closing to make sure of proper patello-femoral tracking and to achieve haemostasis (3).

When all components have been tested and are working (picture1) according to what is expected of it the surgeon will close the incision and place a wound drain before wrapping the knee and the surrounding area in post surgery bandages. (12)



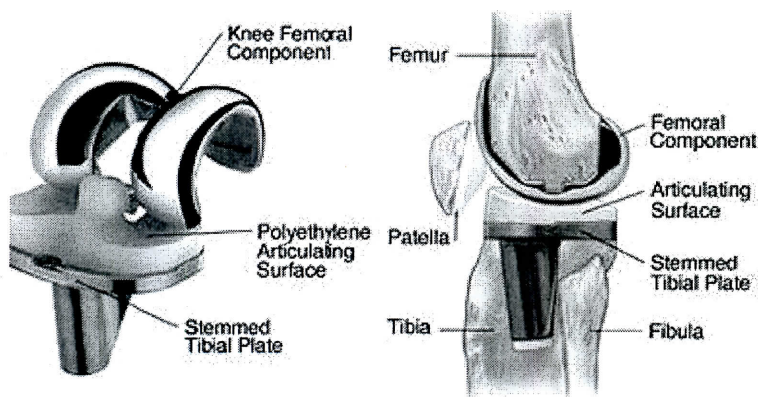
Picture 1: Left knee (flexed) after complete resurfacing of the prosthesis

A well-executed total knee replacement can last up to 15 years (95% predicted survival of the implant). Still, the operation and recovery can be grueling. Traditionally, surgeons make a 12-inch incision in the front of the knee, peel back the kneecap, and cut through the quadriceps muscle and a tendon that attaches it. That allows open access to the thigh and shin bones, which are cut to fit the metal-and-plastic joint implant. After the operation,

there can be wound infection and worse, infection of the knee replacement. These may require prolonged antibiotics and possible removal of the implants. (2)

2.6. Implants

The most common prostheses used in American hospitals for total knee replacement is the Duracon prosthesis. 34,4% of all prosthesis inserted in 2004 was of this brand. The second and third most common prosthesis were the AGC V2 and the P.F.C Sigma with respectively 14,5% and 14,2%. According to the American Arthroplasty Register (2006) there have been inserted 138 different types of prostheses in the years from 1990 to 2004. (9)



Picture 2. The three components of a primary total knee replacement

2.7. Pharmacology

Remedies included not using the affected joint but more recently researchers have found some substances such as glucosamine and chondroitin, as well as apple pectin which have in some cases been able to stimulate regeneration of the cartilage. But often the recommendation consists of losing weight, use of pain killers from aspirin to ibuprofen, and the cox 2 inhibitors, one of which (Vioxx) got into trouble recently because they found it enhanced heart problems. Injecting a gel substitute into the knees has helped but often the relief last for about six months. (6)

2.8. Pre operative care

Preoperative physical conditioning for knee replacement recovery actually begins well before the surgery takes place. The outcome of total-knee arthroplasty has been improved by preoperative planning. Here's why. Successful knee replacement recovery will depend on many different factors but some include the age of the patient, the number of commodities and the general condition of the individual prior to surgery. Patients who are in better physical shape and overall condition tend to have an easier time with the rehab program. Many orthopedic doctors will recommend a patient lose weight and/or strengthen the muscles of the involved leg to better prepare the knee joint for surgery and postoperative rehab. (7)

2.9. Post Operative Care

After the knee replacement surgery, it is expected that the care of the client can become complex as a result of physiological changes that may occur. Another thing is that, the client now has an artificial knee in him and this is something that the client has to get used to. It is crucial to start the total knee replacement recovery as soon as the physician indicates. Early rehabilitation will reduce joint stiffness, swelling, improve overall circulation in the extremity, speed up weight bearing activities and reduce pain. Range of motion exercises, followed by muscle strengthening, are required for at least 6 weeks, and often for 3 months, following total knee arthroplasty. Most patients will have a continuous passive motion (CPM) device placed on the surgical knee within hours of the operation. This mechanical device will provide automatic passive range of motion to the knee while the patient is lying in bed. (5).

The first day after the operation the main goal is to decrease the pain, decrease the swelling.

The patient is allowed to sit up in a chair on the first postoperative day. Verticalization and walking begins on the second day, Some of the goals for total knee replacement recovery is to walk down the hallway with a crutch or walker, climb a short set of stairs, fully straighten their knees, bend the knee to approximately 90° or greater, and perform home exercises independently, strengthening m. quadriceps femoris and gluteal muscles. If the

patient is unable to reach these goals within three to six days, further aggressive rehab is needed. (7).

On the fifth day, the patient is discharged from hospital. Although the patient is generally discharged home, in some parts of the country he or she is discharged to a rehabilitation facility first. Six weeks after surgery for either the hip or knee, the patient is generally ambulatory. After 3 months, most patients are able to return to their previous activities and can usually return to work. Ultimately the goal of replacement recovery is to return the patient to their prior level of function and living environment. After total joint arthroplasty, patients are discouraged from doing heavy labour and participating in strenuous sporting activities. Walking, cycling and swimming are allowed. Running, downhill skiing and competitive tennis are not recommended. (5)

2.10. Physical therapy

Physical therapy is recommended after the total knee replacement. Mechanotherapy is recommended. As part of mechanotherapy, positioning is very important, two kinds of positioning are analgetic and preventive, with flexed knee which will be the analgetic position and with extended knee will be a preventive position for the knee joint, the time between the positioning is from 2 to 4 hours. Patient can start with positioning right after the operation. Another kind of mechanotherapy that can be used after total knee replacement is Motomed, this is continual dynamic positioning, this is recommended after the 2nd or 3rd day of the operation. (7)

Thermotherapy; Cryotherapy is very common to be used specially in the first days after the operation, it is against pain, particularly after the active exercises.

Hydrotherapy; there are endless possibilities to use hydrotherapy, but is going to depend on the stage of the patient, we can use it against swell, pain, inflammation and so on. Underwater massage is good for decrease the swell and to relax all the muscles around the joint. Electrotherapy is contraindicated to use it locally, because of the metal parts on the patient's body. (7)

Magnetotherapy is also recommended, as a part of physical therapy, it is used the low frequency pulse magnetic field for analgetic effect, swell and to accelerate recovery.

Another possibility for the patient after total knee replacement is phototherapy, this includes laser and polarized light biolamp, these are very useful for the scar treatment. (14)

3 Special part

3.1. Methodology

3.1.1 Time and Place

CLPA, Prague, Vysocany, 9th of February, 2009.

3.1.2 Schedule of therapies

The patient had an operation of total knee replacement on February 9th, 2009, there will be performed 10 therapies, starting the 10th of February, ending the 20th of February. The therapies will be 45 minutes long.

3.1.3 Diagnosis⁸

M17.1 Primary Gonarthrosis, unilateral (I), state after total knee

3.1.4 Diagnostic methods

Anthropometric measurements (by Kendall), manual muscle testing (by Kendall), range of motion examination (by Kendall), movement patterns (by Janda), gait examination, palpation, aspection, joint play examination (by Lewit), neurological examination, special test ADL, MMSE (by Barthel)

3.1.5 Therapeutic methods

Thromboembolic preventive exercises, mechanotherapy, range of motion exercises, motomed, gait reeducation, reeducation of certain ADL, PIR (by Lewit), PNF (by Kabat), Manual therapy (by Lewit), soft tissues techniques, cryotherapy.

3.1.6 Diagnostic tools

Measurement tape, goneometer, plum line, neurological hammer.

3.1.7 Therapeutic tools

Motomed, overball, cryopack

3.2 Anamnesis/History

3.2.1 Personal data

Examined person: J.B. male

Date of birth: 1940

3.2.2 History of present problem

Patient complains about left knee pain, it started about 20 years ago, the pain was not sharp, but started increasing with the time and especially after sports. Now hurts when walking long distances or when going downstairs

3.2.3 Chief complaint

Decreased range of motion on knee joint (l) after total knee replacement operation.

3.2.4 Family anamnesis

No major illnesses in his family.

3.2.5 Medical anamnesis

Normal child diseases, no serious injuries, nothing serious.

3.2.6 Surgical anamnesis

2006 right total hip replacement, 2007 left total hip replacement, 10.2.2009 total knee replacement (l)

3.2.7 Pharmacology anamnesis

Tetralex 1-2 daily, Omic 1 daily.

3.2.8 Sport anamnesis

Patient used to play volleyball before the pain started and running, after the pain started, decreased amount of sport activity during the week

3.2.9 Allergies

Negative

3.2.10 Abuses

Social drinker and patient does not smoke

3.2.11 Work anamnesis

Works in a Gas-Energy company for 40 years, mainly office work, sitting for 6-8 hours every day.

3.2.12 Social anamnesis

Living with wife in second floor without elevator, patient has 2 daughters, but they don't live with him.

3.3 Differential diagnosis

Patient had already total replacement of both of his hips (right 2006 and left 2007), both knees are probably affected, as patient had problems with his hips first and had different type of gait which was affecting them a lot.

Operation was performed due to big pain.

Can be expected:

- Structural changes on all the structures of the left knee, because of the arthrosis
- Structural changes on right knee because the patient was using it more because of pain in the left knee
- Neurological problems due to operation for example loss of sensation, nerve paresis, vascularity problems in the skin and in the muscles, psychological problems
- Function changes, like reflex changes, muscles disbalance, for example weakening of m. gluteus medius, m. peroneus longus, or muscle shortness in m. quadriceps, m adductor longus, m. triceps surae, blockage of joints (sacroiliac junction, fibula, patella and all the joints on the foot) bilaterally
- Change of standing and gait stereotype,
- Change of load pressure on both legs

Postoperative complications – weakness, tiredness, low blood pressure, inflammation

3.4 Previous rehabilitation

Patient had rehabilitation when he had his hip replacements. Patient goes to Spa once a year for 3 weeks. For his knee problem he had electrotherapy twice a week (patient doesn't remember details), ultrasound and some exercises. This rehabilitation for the knee helped a little bit for some time but than the pain came back stronger.

3.5 Statement from patient's medical documentation

No previous medical records were available. Unfortunately I didn't have chance to look into the operation protocol.

3.6 Indication of rehabilitation

Patient has been prescribed by his attending physician, to do tromboembolic preventive exercises, right m.quadriceps strengthening exercises, passive movements for the operated leg(l), little by little slow passive and active knee (l)flexion, to recover range of motion of affected leg, knee extension movements on sitting position with operated and healthy leg, standing up (2nd day), walking for short distances with supervision of therapist (3rd day),

walking up and down the stairs (4th day), Motomed machine for 30 minutes with daily angle increase.

3.7 Status presens

Patient is after 1 day of total knee(l) replacement. Patient feels pain after operation in the operated area, mainly in the scar, and feels a little bit weak.. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient mark his pain with 6

Height: 178cm, weight 84kg, BMI=28,39, blood pressure 135/85, respiration/breathing frequency 17 per minute

3.8 Initial kinesiological examination

3.8.1 Aspection

3.8.1.1 Lying on the bed/horizontal position:

Patient is lying in the bed one day after operation of knee (l) replacement, he feels pain. Patient has bandages on his operated leg(l) up to 15 cm above the knee. On his right leg there are also bandages at the same level for tromboembolic prevention.

There is swelling around the whole left knee, there is a scar 8 cm above the patella and 5 cm under the patella

His toes on the operated leg look normal, they have movement. His skin on the lower extremities looks normal, there is some presence of varicous veins, but without pain.

3.8.1.2 Standing position:

Patient can't stand on his own, for this reason this examination couldn't be performed.

3.8.1.3 Gait:

Patient is even not standing yet, for this reason this examination couldn't be performed

3.8.1.4 Examination in sitting position:

Patient sits with difficulty due to the fresh operation and the pain, he sits putting more weight on the right side, which is the unoperated side. The back is bend a little bit to the right side due to his right side weight bearing. He can maintain the sitting position for some time and after he asked to lay back on the bed again.

3.8.2 Examination of reflex changes

- Examination of the skin, subcutis and facias.
- **Left lower extremity:** The movement is restricted on the lateral side of the left knee on the latero-medial direction of the whole skin area, the lateral side of the thigh and also the area of tuberositas tibiae have restricted movement, the scar after the TKR: covered and sterile, is not possible to move the scar because the wound is fresh and covered with stitches, around the scar was possible to stretch the skin without any problems. In the hip area the patient had the old scar of the hip replacement performed years ago, this scar was movable in S direction and in C direction, without any restriction.
- **Right lower extremity:** the movement of the three layers, skin, underskin and fascia, is normal and without any restriction. In the hip area the patient had the old scar of the hip replacement performed years ago, this scar was movable in S direction and in C direction, without any restriction
- **Area of the back:** The skin was movable on its three layers. Kibler fold was performed without any restrictions. This examination was performed on sitting position because the patient was not able to lay on his stomach, due to the recent operation.

For the patient, the skin examination was very comfortable and painless.

- **Examination of trigger points in the muscles of lower extremities**

Trigger points were found in the left m. adductor maximus of the left lower extremity and m. triceps surae of the left lower extremity.

3.8.3 Anthropometric measurements

Table 1. Anthropometric measurements

| Lower extremities | Left | Right |
|---|--------|-------|
| Functional length: SIAS-malleolus med | 94cm | 93cm |
| Anatomical length: troch. major-malleolus lat | 88cm | 87cm |
| Troch. major-lateral condyle of tibia | 45cm | 45cm |
| Caput fibule-malleolus lat. | 40cm | 40cm |
| Knee circumference | 47.5cm | 44cm |
| Quadriceps (10cm above patella) | 53cm | 50cm |
| Quadriceps (15cm above patella) | 58cm | 55cm |

3.8.4 Range of motion in joints

Table 2. Active and passive range of motion on the right leg, Range of motion of operated leg

Right leg(Active)

| | |
|------------------------------|-------------------------------------|
| Hip joint (with flexed knee) | S 10-0-90 F 35-0-15 R 25-0-40 |
| Knee joint | S 0-0-130 |
| Ankle joint | S 60-0-35 |

(Passive)

| | |
|------------------------------|--------------------------------------|
| Hip joint (with flexed knee) | S 15-0-100 F 40-0-20 R 25-0-45 |
| Knee joint | S 0-0-140 |
| Ankle joint | S 60-0-35 |

Operated leg (l)

| | |
|------------|-----------|
| Knee joint | S 10-0-40 |
|------------|-----------|

3.8.5 Manual muscle testing

Table 3. Manual muscle testing

| Muscle | Right lower extremity |
|------------------------------------|-----------------------|
| m.quadriceps | 4 |
| m.semitendinosus+m.semimembranosus | 4 |
| m.biceps femoris | 4 |
| m.triceps surae | 4 |
| m.tibialis anterior | 4 |
| m.gluteus medius | 4 |
| m.gluteus maximus | 4 |

| Muscle | R UE | L UE |
|---------------------|------|------|
| m. biceps brachii | 3 | 3 |
| m. triceps brachii | 3 | 3 |
| m. deltoideus | 5 | 5 |
| m. latissimus dorsi | 4 | 4 |
| m. rectus abdominis | 4 | 4 |

3.8.6 Movement patterns

Hip Abduction

- Change of the movement pattern according to Janda: „Tensor abduction”
- Most of the work is done by m. tensor fascia latae, and gluteus medius the patient did the movement combination correctly
- Main muscles working were, besides m. tensor fascia latae and m. gluteus medius,

m. iliopsoas and m. rectus femoris

Trunk flexion

- Change of the movement pattern according to Janda:
- On the trunk flexion, the first muscles that were activated were the abdominal muscles, than the low back muscles specially the LS segment
- There was a bigger activation of abdominal muscles and slight activation of hip flexors

3.8.7 Joint play examination

Table 4. Joint play examination

| | Examination direction | Right leg | Left leg |
|--------------------|--|----------------|--|
| IP ₁ | Dorsoplantar | Non restricted | Non restricted |
| | Laterolateral | Non restricted | Non restricted |
| IP ₂ | Dorsoplantar | Non restricted | Non restricted |
| | Laterolateral | Non restricted | Non restricted |
| MTP | Dorsoplantar | | Non restricted |
| | Laterolateral | Non restricted | Non restricted |
| | Scissors grasp (metatarsal heads against each other) | Non restricted | Restricted between 3., 4.a 5. head of MTP |
| | | Non restricted | |
| Lisfrank joint | Dorsoplantar | Non restricted | Restricted between 4. and 5. MT and os cuboideum |
| | Rotation | Non restricted | |
| Chopart joint | Dorsal | Non restricted | Non restricted |
| Talus | Tibiofibular | Non restricted | Non restricted |
| Os naviculare | Dorsoplantar | Non restricted | Restricted dorsaly |
| Calcaneus | Rotation | Non restricted | Non restricted |
| | Ventral | Non restricted | Restricted |
| Talocrural joint | Dorsal | Non restricted | Non restricted |
| Tibiofibular joint | Dorsoventral | Restricted | Restricted |

| | | | |
|----------------------|----------------------|----------------|--------------|
| | | dorsaly | |
| Tibiofemoral joint | Anterior drawer sign | Non restricted | Non examined |
| | Posterior draw sign | Non restricted | Non examined |
| Patellofemoral joint | Kraniokaudal | Non restricted | Non examined |
| | Laterolateral | Non restricted | Non examined |
| | Rotation | Non restricted | Non examined |
| SI joint | Ventrodorsal, | Non restricted | Restricted |

3.8.8 Neurological examination:

Examination of physiological reflexes on lower extremities

Tab.5 : Physiological reflexes on lowers extremities

| Reflex: | Evaluation of reflexes: | |
|--|-------------------------|--------------|
| | R LE | L LE |
| Patellar (L ₂₋₄) | 3 | Not possible |
| Reflex of tendom Achilles(L ₅ – S ₂) | 3 | 3 |
| Medioplantar reflex (L ₅ – S ₂) | 3 | 3 |

Legend:

Scale of evaluation by doc. Vélé:

0...areflexia

1...hyporeflexia (reflex is decreased, can be induced by facilitation)

2...hyporeflexia (reflex is decreased, can be induced without facilitation)

3...normoreflexia

4...hyperreflexia (the reflex zone is extended)

5...hyperreflexia (the reflex is increased and it has tendency to repetitions)

-Examination of pyramidal phenomenons on lower extremity

Tab. 6: Examination of spastic a paretic phenomenons

Spastic

| Examination | Result |
|------------------------------|-------------------|
| Babinsky reflex | Without pathology |
| Sicard symptom | Without pathology |
| Chaddockův phenomenon | Without pathology |
| Oppenheim pheonomeno | Without pathology |
| Vítek summing phenomenon | Without pathology |
| Phenomenon Žukovsky-Kornylov | Without pathology |
| Rossolimo phenomenon | Without patology |

Paretic

| Examination | Result |
|----------------------|-------------------|
| Barre phenomenon | without pathology |
| Retardation enomenon | without pathology |

-Peripheral nerve examination (of the operated leg)

n.peroneus communis, without any pathology

n. tibialis, without any pathology

Test finger – nose: passed

Test finger– ear: passed

Test heel – knee: passed by right heel, but not with left because patient couldn't make that kind of movement with his left leg

Diadochokinesis examination - passed

Stretching manouver

Lasseque: left lower extremity, right lower extremity

Reverse Lasseque: it was not possible to do the test because of the pain on his knee, being the first day after the operation was hard to lie on the stomach

Sensation examination:

1) Superficial

Tactile sensation in the area of left knee is changed (a bit increased), everything else is normal

Algic sensation in the area of left knee is changed (a bit increased) everything else in normal

Thermic sensation in the area of left knee is changed (a bit increased) everything else in normal

2) Deep- sensation of pressure in the area of left knee is changed, everything else in normal -motion was done in both talar joints in plantar direction, dorsal flexion, inversion and eversion, all the tests were without pathology

-location sensation – flexion, abduction in metacarpophalangeal joint on fingers on both feet were tested and the aim was to put the second extremity on the same position, test was without pathology, to discard any type of rot syndrome, there was no possibility to do vibration examination, because the center didn't have the tuning fork, but will be performed in the future.

3) stereognosis- recognition of objects with closed eyes (pencil, teddy bear, tissue), without pathology

Balance examination:

- *De Klein test* – negative bilaterally
- *Positional dizziness test* – negative bilaterally
- *Hautant test* – negative bilaterally
- *Romberg standing I, II a III-* can't be tested
- *Standing on one leg-* can't be tested

3.8.9 MMSE test (Mini-Mental State Examination)

Evaluation of mental status, MMSE test (Mini- Mental State Examination)

Tab. 7: Evaluation of mental status according to MMSE test

| | |
|--|-------|
| Orientation | 10 b. |
| Ability of memory | 3 b. |
| Attention and calculation | 5 b. |
| Memory and knowledge | 3 b. |
| Recognition, reproduction, lexia praxia, graphia | 9 b. |
| Total score | 30 b. |

Legend:

25-30 standard

21-24 light cognitive disturbance

16-20 middle grade of cognitive disturbance

15 and less ... heavy grade of cognitive disturbance

3.8.10 Evaluation of ADL, Examination ADL - test according to Barthel

Tab.8: Examination of ADL according to Barthel

| | |
|--------------------------------|-------|
| Nutrition | 10 b. |
| Bathing | 0 b. |
| Care about appearance | 5 b. |
| Dressing | 10 b. |
| Control of defecation | 10 b. |
| Control of bladder | 10 b. |
| Transfer to WC | 0 b. |
| Transfer from bed to the chair | 15 b. |
| Locomotion | 15 b. |

| | |
|--------------|-------|
| Stairs | 0 b. |
| Total score: | 75 b. |

Legend:

- 96- 100 independent
- 61- 95 slightly non independent
- 41- 60 medium non independent
- 40 or lowernon independent

3.9 Conclusion of examination

Patient has still pain for being the first day after operation, he has swollen lower left extremity, and there is a difference of 3 and 4 cm on circumferences due to the bandages. The muscles of the lower extremity right side, are very good with the strength. There is a restricted range of motion on the right hip flexion(r) as well as the internal rotation. This restriction of the hip flexion and internal rotation (r) could be due to the hip replacement (r) that patient had on 2006. It was not possible to do measurements of range of motion or muscle testing on the left side, due to the recent operation of knee (l). We were only able to measure range of motion of knee joint on operated leg (l), and there was restricted range of motion. There was no possibility to perform Gait examination at the beginning of the therapy, due to the recent operation. On the sitting position patient had good stability of trunk and on the muscle test showed good strength of m. rectus abdominis and m. obliquei. The muscle test shows a little bit of weakness on the upper extremities, on m. biceps brachii and m. triceps brachii. There is good movement pattern on hip abduction and flexion of the trunk.

There is a restriction of movement on the skin on the left lower extremity around the knee, lateral side of the thigh and by the tibial tuberosita. Trigger points were found in the left m. adductor maximus of the left lower extremity and m. triceps surae of the left lower extremity. There were 6 restrictions found, between the 3th,4th,5th MTP joint, there is also a restriction on the Lisfrank joint left lower extremity between the 4th and 5th MT joint and Os Calcaneus, and a restriction dorsally on Os naviculare, another one is in tibiofibular joint that is restricted dorsally, and a restriction found on SI joint on the left side. The

reflexes are good, there was not possible to measure the patellar reflex on the left leg, because on the fresh operation. Patient has a level of independence slightly reduced due to the recent operation, which is expectable.

3.10 Short term rehabilitation plan

Decrease the swelling on his operated leg. Exercise and avoid loosing strength on the right side lower extremity. Stretching of the operated knee joint (l), to regain range of motion. Strengthening upper extremities, for appropriate and better usage of crutches. Walking reeducation. Improve mobility on the restricted joints. Stretch the restriction on the skin on the left lower extremity. Remove the trigger points that were found on the muscles of the left lower extremity. Regain full independence

Therapies will be performed according to the guidance and recommendations of CLPA, Prague.

3.11 Course of therapy

Number of therapy: 1

Date: 10.2.2009

Subjective:

Patient complains about slight pain on his operated leg, on the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient mark his pain with 6.

Objective:

The circumference around the operated knee is swollen; the circumference around the swollen knee has 47.5 cm. Edema on his operated leg, restricted range of motion.

Aim of today's therapy unit

Decrease the pain and the swelling on the operated knee. Stretch the restriction on the restriction on the skin around the knee of the operated leg. Start to recover range of motion of operated leg, and exercises to maintain strength on healthy leg and upper extremities. Education of how to sit. Every set of exercises will be performed with a 45 sec pause.

Proposal of therapy

Cryotherapy, soft tissue techniques, ROM exercises, strengthening exercises, reeducation of sitting, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint. Soft tissue techniques around the area of the operated knee.

Today patient will be perform exercise number 1, 3, 4, 5, 7 (see appendix for list of exercises)

Teaching patient how to sit. And how to lay back down using his healthy leg.

Motomed for 30 minutes with 40 degrees angle.

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. ROM is a little bit increasing, although was the first therapy. Patient learned how to sit properly. The swelling is slightly decreased.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 2

Date of therapy: 11.2.2009

Subjective

Patient doesn't complain about pain, although said that he had fever after doing the Motomed machine. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient mark his pain with 3

Objective

Edema on his operated leg, the circumference on his operated leg is 47 cm, restricted range of motion

Aim of today's therapy unit

Decrease the pain and the swelling on the operated knee. Decrease the restriction on the skin around the knee of the operated leg. Renew the joint play on the restricted joints that were found before we start with the walking. Remove the trigger points that were found. Recover range of motion of operated leg, and exercises to maintain strength on healthy leg

and upper extremities. Education of how to stand up and walk a few steps .Every set of exercises will be performed with a 45 sec pause.

Proposal of therapy

Cryotherapy, soft tissue techniques, PIR, joint play, ROM exercises, strengthening exercises, reeducation of standing and walking, Motomed machine.

Fullfilment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint. Soft tissue techniques around the area of the operated knee.

Joint play between the 3th,4th,5th MTP joint, joint play on Lisfrank joint between the 4th and 5th MT joint and Os Calcaneus and joint play on Os naviculare, joint play on tibiofibular joint.

PIR on m. adductor maximus and on m. triceps surae.

Today patient will be perform exercise number 1, 2, 5, 6, 7 (see appendix for list of exercises)

Teaching patient how to stand up walk a few steps.

Motomed for 30 minutes with 45degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing, and the restriction on the joints is decreasing. Patient learned how to stand up and walk a few steps with the crutches.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 3

Date of therapy: 12.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient mark his pain with 2

Objective

Edema and decreased ROM on operated leg (l). Restriction on the skin around the operated knee has decreased. There is still restriction between 3th,4th,5th MTP joint, also on Lisfrank joint between the 4th and 5th MT joint and Os Calcaneus and on Os naviculare, and on tibiofibular joint. Restriction on SI joint on the left side. Trigger points are still present. Circumference of the operated knee has 46.5 cm.

Aim of today's therapy unit

Decrease the pain and the swelling on the operated knee. Stretch the restriction on the skin around the knee of the operated leg. Renew the joint play on the restricted joints that were found. Remove the trigger points that were found. Recover range of motion of operated leg, and exercises to maintain strength on healthy leg and upper extremities. Continue with education how to walk .Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, soft tissue techniques, PIR, joint play, ROM exercises, strengthening exercises, reeducation of walking, Motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint. Soft tissue techniques around the area of the operated knee.

Joint play between the 3th,4th,5th MTP joint, joint play on Lisfrank joint between the 4th and 5th MT joint and on Os Calcaneus and joint play on Os naviculare, joint play on tibiofibular joint and on SI joint left side.

PIR on m. adductor maximus and on m. triceps surae.

Today patient will be perform exercise number 1, 3, 4, 6, 7 (see appendix for list of exercises)

Walking for 30 mtrs and returning to bed.

Motomed for 30 minutes with 50 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing, and the restriction on the joints is decreasing.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 4

Date of therapy: 13.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 2

Objective

Edema and decreased ROM on operated leg (l). Restriction on the skin around the operated knee has decreased. There is less restriction between 3th,4th,5th MTP joint, also on Lisfrank joint between the 4th and 5th MT joint and Os Calcaneus and on Os naviculare, and on tibiofibular joint. Less restriction on SI joint on the left side. Trigger points are still present. Circumference of the operated knee has 46.5 cm.

Aim of today's therapy unit

Decrease the pain and the swelling on the operated knee. Stretch the restriction on the skin around the knee of the operated leg. Renew the joint play on the restricted joints that were found. Remove the trigger points that were found. Recover range of motion of operated leg, and exercises to maintain strength on healthy leg and upper extremities. Walking. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, soft tissue techniques, PIR, joint play, ROM exercises, strengthening exercises, reeducation of walking, Motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint. Soft tissue techniques around the area of the operated knee.

Joint play between the 3th,4th,5th MTP joint, joint play on Lisfrank joint between the 4th and 5th MT joint and on Os Calcaneus and joint play on Os naviculare, joint play on tibiofibular joint and on SI joint left side.

PIR on m. adductor maximus and on m. triceps surae.

Today patient will be perform exercise number 3, 4, 5, 6, 7 (see appendix for list of exercises)

Walking for 40 mtrs and returning to bed.

Motomed for 30 minutes with 55 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing, and the restriction on the joints is decreasing.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy :5

Date of therapy: 14.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 1

Objective

Edema and decreased ROM on operated leg (l). Restriction on the skin around the operated knee has decreased. There is less restriction between 3th,4th,5th MTP joint, also on Lisfrank joint between the 4th and 5th MT joint and Os Calcaneus and on Os naviculare, and on tibiofibular joint. Less restriction on SI joint on the left side. Trigger points are still present. Circumference of the operated knee has 46.5 cm.

Aim of today's therapy unit

Decrease the pain and the swelling on the operated knee. Stretch the restriction on the skin around the knee of the operated leg. Renew the joint play on the restricted joints that were found. Remove the trigger points that were found. Recover range of motion of operated leg, and exercises to maintain strength on healthy leg and upper extremities. Walking and education on going up and down the stairs. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, soft tissue techniques, PIR, joint play, ROM exercises, strengthening exercises, continue with reeducation of walking, reeducation of walking up and down the stairs, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint. Soft tissue techniques around the area of the operated knee.

Joint play between the 3th,4th,5th MTP joint, joint play on Lisfrank joint between the 4th and 5th MT joint and on Os Calcaneus and joint play on Os naviculare, joint play on tibiofibular joint and on SI joint left side.

PIR on m. adductor maximus and on m. triceps surae.

Today patient will be perform exercise number 1, 2, 4, 6, 7 (see appendix for list of exercises)

Walking for 50 mtrs and going up and down the stairs.

Motomed for 30 minutes with 60 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing, and the restriction on the joints is decreasing. There is almost no restriction on the skin around the operated knee area.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 6

Date of therapy: 16.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 1. Patient states that he feel more range of motion on his operated leg.

Objective

Edema has decreased and patient has improved ROM on operated leg (l). Circumference of the operated knee has 46.5 cm. Restriction on the skin around the operated knee has decreased. There is no restriction between 3th,4th,5th MTP joint, neither on Lisfrank joint between the 4th and 5th MT joint. Os Calcaneus and Os naviculare are free of restriction, no restriction on tibiofibular joint. Trigger points are still present. Less restriction on SI joint on the left side. Patient has wrong timing when performing the PNF diagonal. The left lower extremity is a little bit weak.

Aim of today's therapy unit

Decrease the pain and the swelling on the operated knee. Stretch the restriction on the skin around the knee of the operated leg. Renew the joint play on SI joint. Remove the trigger points that were found. PNF to improve timing education for operated leg and to gain strength and ROM. Exercises to maintain strength on operated and healthy leg and upper extremities. Walking and on going up and down the stairs. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, soft tissue techniques, PIR, joint play, PNF, ROM exercises, strengthening exercises, continue with reeducation of walking, reeducation of walking up and down the stairs, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint. Soft tissue techniques around the area of the operated knee.

Joint play on SI joint left side. PNF first diagonal flexion and extension on the operated leg only passively.

PIR on m. adductor maximus and on m. triceps surae.

Today patient will be perform exercise number 1, 2, 3, 4, 5 (see appendix for list of exercises)

Walking for 50 mtrs and going up and down the stairs.

Motomed for 30 minutes with 60 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing, and the restriction on the SI joint is decreasing. There is almost no restriction on the skin around the operated knee area. Education of PNF diagonal was successful. Trigger points are not present anymore.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 7

Date of therapy: 17.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 1.

Objective

Edema has decreased and patient has improved ROM on operated leg (l). Circumference of the operated knee has 46 cm. There is no restriction on the skin around the operated knee. There is less restriction on SI joint on the left side. No presence of trigger points on m. adductor maximus and no presence of trigger points on m. triceps surae. Left lower extremity is still a little bit weak, but is improving and timing is good.

Aim of today's therapy unit

Decrease the swelling on the operated knee. Renew the joint play on SI joint. PNF on operated leg, to gain strength and ROM. Exercises to maintain strength on operated and healthy leg and upper extremities. Walking and on going up and down the stairs. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, PNF, joint play, ROM exercises, strengthening exercises, continue with reeducation of walking, reeducation of walking up and down the stairs, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint.

Joint play on SI joint left side. PNF hold-reversal-active movement first diagonal flexion and extension on the operated leg.

Today patient will be perform exercise number 1, 3, 4, 5, 7 (see appendix for list of exercises)

Walking for 50 mtrs and going up and down the stairs.

Motomed for 30 minutes with 65 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing, and the restriction on the SI joint is decreasing. There is almost no restriction on the skin around the operated knee area. PNF diagonal was successful. Trigger points are not present anymore.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 8

Date of therapy: 18.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 1.

Objective

Edema has decreased and patient has improved ROM on operated leg (l). Circumference of the operated knee has 46 cm. There is no restriction anymore on SI joint on the left side. Left lower extremity is still a little bit weak but is improving and timing on the diagonal is good.

Aim of today's therapy unit

Decrease the swelling on the operated knee. PNF on operated leg, to gain strength and ROM, recover range of motion of operated leg, and exercises to maintain strength on healthy leg and upper extremities. Continuing with the education of walking, and going up and down the stairs. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, PNF, ROM exercises, strengthening exercises, continue with reeducation of walking, continue with reeducation of walking up and down the stairs, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint.

PNF hold-relax-active movement first diagonal flexion and extension on the operated leg.

Today patient will be perform exercise number 1, 2, 4, 5, 6 (see appendix for list of exercises)

Walking for 50 mtrs and going up and down the stairs.

Motomed for 30 minutes with 70 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing. There is no restriction on the skin around the operated knee area. PNF diagonal was successful. Trigger points are not present anymore.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 9

Date of therapy: 19.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 1.

Objective

Edema has decreased and patient has improved ROM on operated leg (l). Circumference of the operated knee has 46 cm. Left lower extremity is still a little bit weak but is improving and timing on the diagonal is good

Aim of today's therapy unit

Decrease the swelling on the operated knee. PNF on operated leg, to gain strength and ROM, recover range of motion of operated leg, and exercises to maintain strength on

healthy leg and upper extremities. Continuing with the education of walking, and going up and down the stairs. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, PNF, ROM exercises, strengthening exercises, continue with reeducation of walking, continue with reeducation of walking up and down the stairs, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint.

PNF quick-reversal movement first diagonal flexion and extension on the operated leg.

Today patient will be perform exercise number 1, 2, 3, 4, 6 (see appendix for list of exercises)

Walking for 50 mtrs and going up and down the stairs.

Motomed for 30 minutes with 75 degrees angle

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing. PNF diagonal was successful.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee.

Number of therapy: 10

Date of therapy: 20.2.2009

Subjective

Patient is relaxed and doesn't complain about any pain. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient marks his pain with 1.

Objective

Edema has decreased and patient has improved ROM on operated leg (l). Circumference of the operated knee has 46 cm. Left lower extremity is still a little bit weak but is improving and timing on the diagonal is good.

Aim of today's therapy unit

Decrease the swelling on the operated knee. PNF on operated leg, to gain strength and ROM, recover range of motion of operated leg, and exercises to maintain strength on healthy leg and upper extremities. Continuing with the education of walking, and going up and down the stairs. Every set of exercises will be performed with a 45 sec pause

Proposal of therapy

Cryotherapy, PNF, ROM exercises, strengthening exercises, continue with reeducation of walking, continue with reeducation of walking up and down the stairs, motomed machine.

Fulfillment of therapy

Tromboembolic preventive exercises, doing flexion and extension in the talar joint.

PNF hold-relax-active movement first diagonal flexion and extension on the operated leg.

Today patient will be perform exercise number 2, 3, 4, 5, 7 (see appendix for list of exercises)

Walking for 50 mtrs and going up and down the stairs.

Motomed for 30 minutes with 80 degrees angle.

Effect of therapy

Patient assimilated very good the exercises, didn't complain about pain. The swelling is decreasing. PNF diagonal was successful.

Self-therapy

Patient will performed the same exercises one more time in the afternoon. Same number of sets and repetitions. As well as the Motomed. Patient will put cryopack 3 times per day on his operated knee

3.12 Final kinesiological examination**3.12.1 Status presens**

Patient is after 1 day of total knee(l) replacement. Patient doesn't feel pain anymore in the operated area. On the scale from 0 to 10 (where 10 is intolerable pain and 0 is painless) patient mark his pain with 1

Height: 178cm, weight 84kg, BMI=28,39, blood pressure 135/85, respiration/breathing frequency 17 in minute

3.12.2 Aspection

3.12.2.1 Lying on the bed/horizontal position:

The swelling on the operated knee has decreased. there is a scar 8 cm above the patella and 5 cm under the patella, but stitches are still there, the scar looks sterile.

The skin around the operated knee has normal color and is not dry.

3.12.2.2 Standing position:

Patient has a normal position, not bearing weight to any side. Patient has to use crutches.

3.12.2.3 Gait:

Rhythm is in a continuous way using the crutches, the stance is narrow, the distance of the steps are the same, there is good movement of feet while walking, first the heel, then the lateral side of the foot and finally the toes, pelvis is slightly tilted posteriorly, caused by avoiding putting weight on the operated leg (l), movement of upper extremities is normal using the crutches, there is no movement of head while walking

3.12.2.4 Examination in sitting position:

Patient sits without any difficulty, he sits dividing the weight on each side, which is correct side. He can maintain the sitting position without any problems.

3.12.3 Examination of reflex changes

- The swelling has decreased notoriously, the skin around the operation is red, warm, soft.
- Examination of the skin, subcutis and fascia.
- **Left lower extremity:** There is no restriction on any layer around the operated area. the scar is still covered and sterile, is not possible to move the scar because the wound is covered with stitches, around the scar was possible to stretch the skin without any problems. In the hip area the patient had the old scar of the hip replacement performed years ago, this scar was movable in S direction and in C direction, without any restriction.
- **Right lower extremity:** the movement of the three layers, skin, underskin and fascia, is normal and without any restriction. In the hip area the patient had the old

scar of the hip replacement performed years ago, this scar was movable in S direction and in C direction, without any restriction

- **Area of the back:** The skin was movable on its three layers. Kibler fold was performed without any restrictions.
- **Examination of trigger points in the muscles of lower extremities**
There is no presence of trigger points.

3.12.4 Anthropometric measurements

Table 9. Anthropometric measurements (final)

| Lower extremities | Left | Right |
|---|-------------|-------|
| Functional length: SIAS-malleolus med | 93.5cm | 93cm |
| Anatomical length: troch. major-malleolus lat | 87cm | 87cm |
| Troch. major-lateral condyle of tibia | 45cm | 45cm |
| Caput fibule-malleolus lat. | 40cm | 40cm |
| Knee circumference | 46cm | 44cm |
| Quadriceps (10cm above patella) | 51cm | 50cm |
| Quadriceps (15cm above patella) | 56cm | 55cm |

3.12.5 Range of motion in joints

Table 10. Active and passive range of motion on the right leg, Range of motion of operated leg (final)

| | |
|------------------------------|-------------------------------------|
| Hip joint (with flexed knee) | S 10-0-90 F 35-0-15 R 25-0-40 |
| Knee joint | S 0-0-130 |

| | |
|------------------------------|--------------------------------------|
| Ankle joint | S 60-0-35 |
| (Passive) | |
| Hip joint (with flexed knee) | S 15-0-100 F 40-0-20 R 25-0-45 |
| Knee joint | S 0-0-140 |
| Ankle joint | S 60-0-35 |
| Operated leg (l) | |
| Knee joint | S 5-0-85 |

3.12.6 Manual muscle testing

Table 11. Manual muscle testing (final)

| Muscle | Left lower extremity | Right lower extremity |
|------------------------------------|----------------------|-----------------------|
| m.quadriceps | 3 | 5 |
| m.semitendinosus+m.semimembranosus | 3 | 5 |
| m.biceps femoris | 3 | 5 |
| m.triceps surae | 4 | 5 |
| m.tibialis anterior | 5 | 5 |
| m.gluteus medius | 4 | 5 |
| m.gluteus maximus | 4 | 5 |

| Muscle | R UE | L UE |
|---------------------|------|------|
| m. biceps brachii | 4 | 4 |
| m. triceps brachii | 4 | 4 |
| m. deltoideus | 5 | 5 |
| m. latissimus dorsi | 5 | 5 |
| m. rectus abdominis | 4 | 4 |

3.12.7 Movement patterns

Hip Abduction

- Change of the movement pattern according to Janda: „Tensor abduction”
- The movement was improved and much better, the order of the muscles was the correct one. Using as a first muscle m.gluteus medius

Trunk flexion

- Change of the movement pattern according to Janda:
- On the trunk flexion, the first muscles that were activated were the abdominal muscles.
- There was mainly activation of abdominal muscles and slight activation of hip flexors

3.12.8 Joint play examination

Table 12. Joint play examination (final)

| | Examining direction | Right leg | Left leg | | |
|-----------------|--|----------------|-----------------------|----------------|-----------------------|
| IP ₁ | Dorsoplantar | Not restricted | Not restricted | | |
| | Laterolateral | Not restricted | Not restricted | | |
| IP ₂ | Dorsoplantar | Not restricted | Not restricted | | |
| | Laterolateral | Not restricted | Not restricted | | |
| MTP | Dorsoplantar | Not restricted | Not restricted | | |
| | Laterolateral | | | | |
| | Scissors grasp (metatarsal heads against each other) | | | Not restricted | Not restricted |
| | | | | Not restricted | Not restricted |
| Lisfrank joint | Dorsoplantar | Not restricted | Not restricted | | |
| | Rotation | Not restricted | Not restricted | | |
| Chopart joint | Dorsal | Not restricted | Not restricted | | |
| Talus | Tibiofibular | Not restricted | Not restricted | | |
| Os naviculare | Dorsoplantar | Not restricted | Not restricted | | |
| Calcaneus | Rotacion | Not restricted | Not restricted | | |

| | | | |
|----------------------|----------------------|----------------|-----------------------|
| | Ventral | Not restricted | Not restricted |
| Talocrural joint | Dorsal | Not restricted | Not restricted |
| Tibiofibular joint | Dorsoventral | Not restricted | Not restricted |
| Tibiofemoral joint | Anterior drawer sign | Not restricted | Not restricted |
| | Posterior draw sign | Not restricted | Not restricted |
| Patellofemoral joint | Craniocaudal | Not restricted | Not restricted |
| | Laterolateral | Not restricted | Not restricted |
| | Rotation | Not restricted | Not restricted |
| SI joint | Ventrodorsal, | Not restricted | Not restricted |

3.12.9 Neurological examination

-Examination of physiological reflexes on lower extremities

Tab.13 : Physiological reflexes on lowers extremities (final)

| Reflex: | Evaluation of reflexes: | |
|--|-------------------------|----------|
| | R LE | L LE |
| Patellar (L ₂₋₄) | 3 | 3 |
| Reflex of tendom Achilles(L ₅ – S ₂) | 3 | 3 |
| Medioplantar reflex (L ₅ – S ₂) | 3 | 3 |

Scale of evaluation by doc. Véle:

Legend:

0...areflexia

1...hyporeflexia (reflex is decreased, can be induced by facilitation)

2...hyporeflexia (reflex is decreased, can be induced without facilitation)

3...normoreflexia

4...hyperreflexia (the reflex zone is extended)

5...hyperreflexia (the reflex is increased and it has tendency to repetitions)

-Examination of pyramidal phenomenons on lower extremity

Tab. 14: Examination of spastic a paretic phenomenons (final)

Spastic

| Examination | Result |
|------------------------------|-------------------|
| Babinsky reflex | Without pathology |
| Sicard symptom | Without pathology |
| Chaddockův phenomenon | Without pathology |
| Oppenheim pheonomeno | Without pathology |
| Vítek summing phenomenon | Without pathology |
| Phenomenon Žukovsky-Kornylov | Without pathology |
| Rossolimo phenomenon | Without pathology |

Paretic

| Examination | Result |
|----------------------|-------------------|
| Barre phenomenon | without pathology |
| Retardation enomenon | without pathology |

-Peripheral nerve examination (of the operated leg)

n.peroneus communis, without any pathology

n. tibialis, without any pathology

Test finger – nose: passed

Test finger– ear: passed

Test heel – knee: passed by right heel, but not with left because patient couldn't make that kind of movement with his left leg

-Diadochokinesis examination - passed

-Stretching manouver

Lasseque: left lower extremity, right lower extremity, no signs of pathology

Reverse Lasseque: left lower extremity and right lower extremity, no signs of pathology

-Sensation examination:

1) Superficial

Tactile sensation in the area of left knee is changed normal

Algic sensation in the area of left knee is normal

Thermic sensation in the area of left knee normal

2) deep- sensation

Pressure in the area of left knee is normal, everything else in normal

-motion was done in both talar joints in plantar direction, dorsal flexion, inversion and eversion, all the tests were without pathology

-Location sensation – flexion, of hip and flexion of knee joint were tested and the aim was to put the second extremity on the same position, without pathology

3) stereognosis- recognition of objects with closed eyes (pencil, teddy bear, tissue), without pathology

-Balance examination:

- *De Klein test* – negative bilaterally

- *Positional dizziness test* – negative bilaterally

- *Hautant test* – negative bilaterally

- *Romberg standing I, II a III-* can't be tested

- *Standing on one leg-* negative

3.12.10 MMSE test (Mini-Mental State Examination)

Evaluation of mental status, MMSE test (Mini- Mental State Examination)

Tab. 15: Evaluation of mental status according to MMSE test (final)

| | |
|--|-------|
| Orientation | 10 b. |
| Ability of memory | 3 b. |
| Attention and calculation | 5 b. |
| Memory and knowledge | 3 b. |
| Recognition, reproduction, lexia praxia, graphia | 9 b. |
| Total score | 30 b. |

Legend:

25-30 standard

21-24 light cognitive disturbance

16-20 middle grade of cognitive disturbance

15 and less ... heavy grade of cognitive disturbance

3.12.11 Evaluation of ADL, Examination ADL - test according to Barthel

Tab.16: Examination of ADL according to Barthel (final)

| | |
|--------------------------------|-------|
| Nutrition | 10 b. |
| Bathing | 7 b. |
| Care about appearance | 10 b. |
| Dressing | 10 b. |
| Control of defecation | 10 b. |
| Control of bladder | 10 b. |
| Transfer to WC | 10 b. |
| Transfer from bed to the chair | 10 b. |
| Locomotion | 10 b. |
| Stairs | 10 b. |
| Total score: | 97 b. |

Legend:

96- 100 independent

61- 95 slightly non independent

41- 60 medium non independent

40 or lowernon independent

3.13. Evaluation of therapeutic effect

After the daily exercises and therapy, patient has improved his ROM. There was a slow daily improve. His gate with the crutches improved in a good way, he is able to walk with the crutches for small distances, and patient is able to go up and down the stairs. His muscles of his right side lower extremity are strong, as well as his upper extremities, this will allow him to feel secure when using the crutches everyday. His restriction on the operated leg changed from 40 degrees knee flexion to 85 degrees after two weeks of the operation and two weeks of therapy, and his knee extension on his operated leg changed from 10 degrees to 5 degrees extension. The edema that had the operated knee (l), decreased after the two weeks of therapy, it was very important and useful that the patient didn't put any weight on his operated leg (l) while walking. Manual muscle testing was performed on the operated leg (l) and the results show that the strength is coming back, due to the decrease of the pain and the increase of ROM.

The range of motion on his left knee joint improved 45 degrees on flexion and as well as in extension where he had a 10 degree improve having now 0 degrees. Now patient has a ROM of the left knee S 0-0-85.

Patient's expected range of motion of operated knee (l) is 90-110 degrees, he will get to this point depending on how much emphasis patient and therapist will put into his recover. This will allow him to be independent in his ADL and get back into his normal life, work, family, etc.

The movement patter on the hip abduction and trunk flexion showed normal results.

A gait examination was also performed during the last session of therapy. Patient rhythm is continuous using the crutches, it shows no discomfort while walking, movement of feet is good, and after the daily walking reeducation, patient is tilting the pelvis posteriorly much

less than before. Still patient avoids putting weight on the operated leg (l). Upper extremities movement is good using the crutches and the head doesn't move while walking. There are no restrictions on any joints; there is no presence of trigger points anymore. The patient has gained mayor level of independency after the therapies.

3.14 Long term plan

After 1 month of the operation, patient can start putting weight on the operated leg and this will improve slowly the gait without crutches. Patient can use balance board, on sitting position to start training the stabilization of the knee. After the 2 months of the operation patient can put half of the weight on his operated leg. After the 3rd month the patient should have an x ray should taken and after this is checked, he can put whole weight on the operated leg, and can start doing his working activities as well as light sport activities. According to this basic therapy purpose we could say that patient should improve his balance, improve his dynamic stabilization of the knee joint, proprioceptive neuro muscular training for lower extremities, reeducation of gait stereotype and attend to spa therapy.

4 Conclusion

Patient was very cooperative, although the opportunity to do the therapy was for only 2 weeks, equal to 10 therapies. Patient showed a big improve on regaining his range of motion on operated leg, and this also motivated the patient day by day. Patient will continue with his rehabilitation in a different rehabilitation center near Prague.

Doing the information research, finding the information sources, working with the patient was a great experience for me. It also showed me the difference between working as a physiotherapist in Czech Republic and my country Ecuador.

We can state that all the goals were achieved during the rehabilitation period.

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Appendices

List of Appendices

1. Ethics Board Review
2. Information consent
3. List of exercises
4. Patient's operated knee (1 day after the operation)
5. Patient's operated knee after the 10 therapies provided

Ethics Board Review



CHARLES UNIVERSITY IN PRAGUE
FACULTY OF PHYSICAL EDUCATION AND SPORT
José Martího 31, 162 52 Praha 6-Vešelavín
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<http://www.ftvs.cuni.cz/>

Application for Ethics Board Review

Of the research project, undergraduate research, involving human subjects

Project title: Arthrosis and Total Knee Replacement

Nature of the research project: basic research / undergraduate research

Author (chief investigator): Klaus Jungbluth

Supervisor (in case of student research): Ph.Dr. Michaela Prokesova Ph.D.

Case study of the physiotherapy of the patient with diagnosis: Total knee replacement and Arthrosis will be processed with supervision of skilled physiotherapist in: CLPA, Centrum Lechy Pohyboveho Aparatu
No invasive method will be used. Personal datas will be not published.
Informed consent (in Czech language, attached)

Date: 18.02.09

Author's signature:

Klaus Jungbluth

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 Slepíčka, 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: 0273/2009
Date: 20.2.2009

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



Signature, REB Chairman

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 k vyšetření a následné terapii. Dále Vás žádám o souhlas k nahlížení 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.

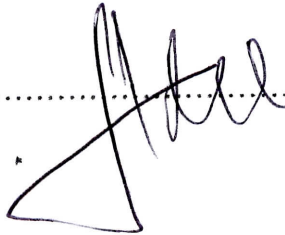
Dnešního dne jsem byl/a odborným pracovníkem poučen/a o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měl/a jsem možnost klást mu otázky, na které mi řádně odpověděl. Prohlašuji, že jsem shora uvedenému poučení plně porozuměl/a a výslovně souhlasím s provedením vyšetření a následnou terapií.

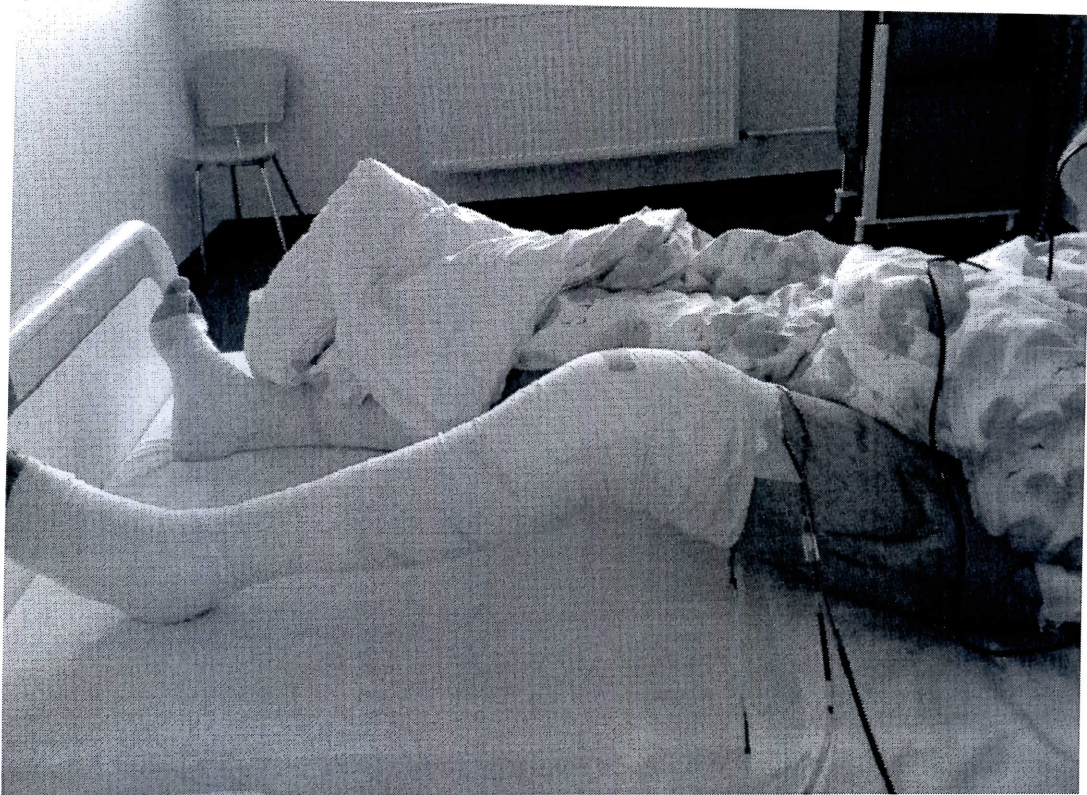
Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum: 9.2.09.....

Osoba, která provedla poučení: Klaus Jungbluth

Podpis osoby, která provedla poučení: Ky

Vlastnoruční podpis pacienta /tky: 



Patient's operated knee in max. flexion (1 day after the operation)



Patient's operated knee on max flexion after the 10 therapies provided