

CHARLES UNIVERSITY

FACULTY OF PHYSICAL EDUCATION AND SPORTS

Department of physiotherapy

A case study of physiotherapy treatment of arthrosis patient after
total knee replacement

Bachelor's thesis

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Abstract

Title: A Case study of physiotherapy treatment of arthrosis patient after total knee replacement.

Thesis aim: The aim of this thesis is to review the rehabilitation of a patient after total knee replacement due to osteoarthritis. It is divided into two parts theoretical part review and describe the anatomical structure of the knee, kinesiology, biomechanics and development and disease. The practical part aims to describe the examination procedures, therapy implementations and conclusion for the patient in relation to the given diagnose.

Clinical findings: This case study reviews the conditions of a 50 years old patient after a total knee replacement. The patient had limited mobility and restricted joints around the operated side. There right knee has a swelling, change of skin colour, temperature and a scar.

Methods: All the used procedures were based on the literature given thought by the Charles University in Prague, Faculty of Physical Education and Sports.

Result: patient was committed to the therapeutic sessions, the patient case progressed positively with the pain, range of motion and muscle imbalance for the knee joints.

Conclusion: The applied therapies had a positive effective for patient case.

Keywords: Osteoarthritis, Knee joint, Varus deformity, knee pain, Ankle stiffness, knee replacement.

Abstraktní

Název: Případová studie fyzioterapeutické léčby pacienta s artrózou aplikaci totální endoprotézy kolenního kloubu po totální výměně kolene.

Cíl práce: Cílem této práce je zhodnotit rehabilitaci pacienta po totální náhradě kolene v důsledku osteoartrózy. Je rozdělena na dvě části, teoretickou část, přehled a popisuje anatomickou strukturu kolene, kineziologii, biomechaniku a vývoj a onemocnění.

Praktická část si klade za cíl popsat vyšetřovací postupy, implementaci terapie a závěr pacienta ve vztahu k dané diagnóze.

Klinické nálezy: Tato kazuistika shrnuje stav 50letého pacienta po celkové výměně kolene. Pacient měl omezenou pohyblivost a omezené rozsahy pohybů kloubu kolem operované strany. Pravé koleno je otekl, vykazuje změnu barvy kůže, teplotu a jizvu.

Metody: Všechny použité postupy vycházely z literatury dané Univerzitou Karlovou v Praze, Fakultou tělesné výchovy a sportu.

Výsledek: Pacient byl zavázán k terapeutickým sezením, případ pacienta se vyvíjel pozitivně s bolestí, rozsahem pohybu a svalovou nerovnováhou kolenních kloubů.

Závěr: Aplikované terapie měly pozitivní účinek na léčbu pacienta.

Klíčová slova: Osteoartritida, kolenní kloub, Varus deformita, bolest kolena, ztuhlost kotníku, náhrada kolene.

Declarations

I hereby declare that this bachelor thesis work is entirely my own, individual work on knowledge from books, articles, journals and by attending seminars and lectures at Charles University in Prague at FTVS.

I also declare that no invasive methods were used during the practical approach and that the patient was fully aware of the procedures at any given time.

Prague , October 2019

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1 Introduction

The knee joint is one of the most important joints within the human body. although it doesn't provide a wide range of motion, it does play a major role in bearing the weight of the entire body and. The joint is supported and stabilized by various muscles. It is common for ligament injuries to occur in the knee and injreies can occur due to trauma such as overloading or wrong movement during sport Also arthritis is a common disses that could affect the joint. Knee injuries and Osteoarthritis usually are treated through surgery by using various approaches, for example surgery in which the serious cases a total knee replacement. The risk of knee Osteoarthritis increase dramatically with age and other factors we are going to explore in my thesis.

The main objective of this thesis is to demonstrate, analyse and provide in depth information about the physiotherapeutic intervention and management of a Patient after Total Knee Replacement due to Osteoarthritis.

The practice for this thesis took place at The Rehabilitation department of Kladno's Hospital in Kladno, Czech Republic, from the 4th of February 2019 till the 15th of February 2019.

2 General part

2.1 Anatomy of the knee

The largest joint in the human body, also the most complex one, it's a compound joint, as it consists of a joint between femur and tibia, and a joint between femur and patella. Although it is described as a hinge type of a synovial joint in which is possible only two motions: flexion and extension, it also could have slight internal and external rotation about a vertical axis also can occur when the knee is flexed. (1,2)

2.1.1 The bones of the knee joint

The knee joint consist of 3 bones are the femur, the patella and the tibia. In which the joint keeps these bones in place.

The femur is found in the upper part of the leg and it is the longest bone in the body. The femur articulates proximally with the acetabulum of the pelvis to form the hip joint, and distally with the tibia and patella by femoral condyles to form the knee joint. (1,2)

The tibia, or shin bone, spans the lower leg, articulating proximally with the femur and patella at the knee joint, and distally with the tarsal bones, to form the ankle joint. It is the major weight-bearing bone of the lower leg. (1,2)

The patella is located at the front of the knee joint, within the patellofemoral groove of the femur. Its superior aspect is attached to the quadriceps tendon, and inferior aspect to the patellar ligament. It is classified as a sesamoid type bone due to its position within the quadriceps tendon, and is the largest sesamoid bone in the body. (1,2)

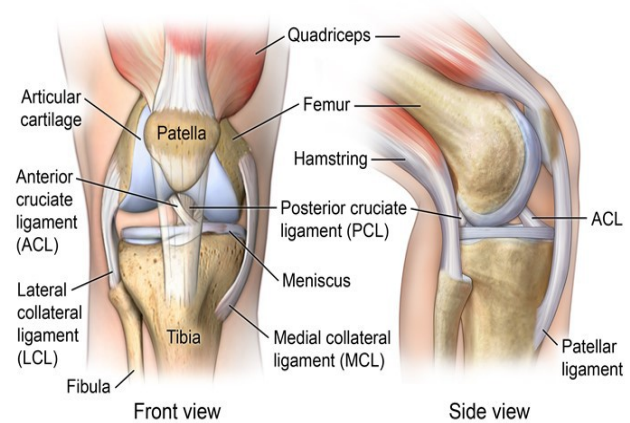


Figure 1 Bones of the Knee (1)

2.1.2 Articular surfaces

The knee joint consists of the tibiofemoral articulation and the patellofemoral articulation. The joint surfaces are lined with hyaline cartilage, and are enclosed within a single joint cavity. The Tibiofemoral surface consist of the medial and lateral condyles of the femur articulate with the tibial condyles. It is the weight-bearing component of the knee joint. And the patellofemoral surface anterior aspect of the distal femur articulates with the patella. It allows the tendon of the quadriceps femoris to be inserted directly over the knee increasing the efficiency of the muscle. (1,2)

As the patella is both formed and resides within the quadriceps femoris tendon, it provides a fulcrum to increase power of the knee extensor, and serves as a stabilising structure that reduces frictional forces placed on femoral condyles. (1,2)

2.1.3 Joint capsule

The articular capsule of the knee joint surrounds the knee and consists of two main layers, an outer and inner layer. The outer layer is made up of a tough, fibrous membrane that is made up of ligament tissue. It is attached to the femur from superior aspect, inferiorly, also it is attached to the tibial plateau, posteriorly it surrounds the condyles and intercondylar fossa, anteriorly it is attached to the quadriceps tendon, patella and patellar ligament The main function is to provide stability to the joint by holding the bones of the knee (femur, tibia, patella) in their correct positions in the knee. (1,2)

The inner layer is made up of a synovial membrane, which secretes, a clear, yellowish fluid called synovial fluid which covers the internal aspect of the fibrous capsule and it is attached to the periphery of the patella and the edges of menisci. The articular capsule of the knee also contains bursae, which are fluid filled sacs, and a fat pad located behind the patella. (1,2,7)

2.1.4 Menisci

The medial and lateral menisci are fibrocartilage structures of the knee joint comprised of both a medial and a lateral component situated between the corresponding femoral condyle and tibial plateau. They are C shaped, and attached at both ends to the intercondylar area of the tibia. In addition to the intercondylar attachment, the medial meniscus is fixed to the tibial collateral ligament and the joint capsule. Damage to the tibial collateral ligament usually results in a medial meniscal tear.

The lateral(external) meniscus is smaller and does not have any extra attachments, rendering it fairly mobile. (1,2,22)

2.1.5 Bursae

A bursa is a fluid-filled structure that is present between the skin and tendon or tendon and bone. The main function of a bursa is to reduce friction between adjacent moving structures

Bursae around the knee can be grouped as those that occur around the patella and those that occur elsewhere. Bursae around the patella include the prepatellar bursa, the superficial and deep infrapatellar bursae, and the suprapatellar bursa. Bursae that are not anatomically close to the patella include the pes anserine bursa, the iliotibial bursa, the tibial and fibular collateral ligament bursae and the gastrocnemius-semimembranosus bursa. On MRI imaging, bursitis appears as an oblong fluid collection in its expected anatomical location. (1,2)

2.1.6 Ligaments

There are four major ligaments in the knee. Ligaments are elastic bands of tissue that connect bones to each other and provide stability and strength to the joint. Muscles of the knee joint, innervation and function of them. The medial collateral ligament (MCL) is located on the inside of the knee joint. It extends from the medial femoral epicondyle to the tibia. This ligament prevents the excessive abduction of the knee. It is a thick ligament that typically does not require surgery to repair if it becomes injured. The lateral collateral ligament (LCL) is located on the outside of the knee joint. It extends from the lateral femoral epicondyle to the head of the fibula. This ligament prevents excessive adduction of the knee. The anterior cruciate ligament (ACL) extends posterolaterally from the tibia and inserts on the lateral femoral condyle. This ligament prevents excessive anterior movement of the tibia under the femur. It keeps your shin bone from sliding too far forward during running, hopping, and cutting activities. The posterior cruciate ligament (PCL) extends anteromedially from the tibia posterior to the medial femoral condyle. This ligament prevents excessive anterior movement of the femur on the tibia. (1,2,7)

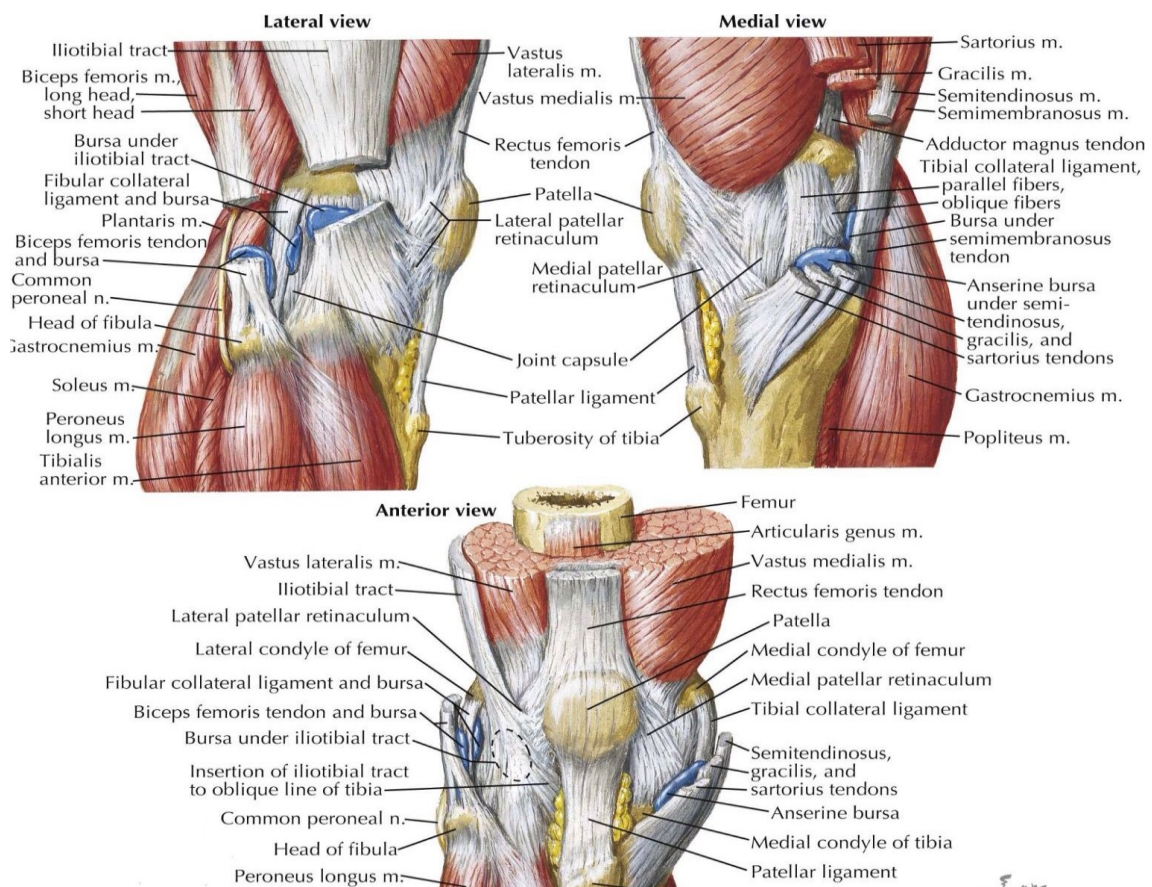


Figure 2 The Anatomy of the knee joint (2)

2.1.7 Muscles of the knee joint

muscle	Origin	Insertion	Innervation	Action
Rectus femoris	Anterior inferior iliac spine	Tibial tuberosity	Femoral nerve	Hip flexion Knee extension
Vastus medialis	Medial lip of linea aspera of femur	Tibial tuberosity	Femoral nerve	Knee extension
Vastus lateralis	Linea aspera	Tibial tuberosity	Femoral nerve	Knee extension
Vastus intermedius	Upper anterior femoral shaft	Tibial tuberosity	Femoral nerve	Knee extension
Biceps femoris	Ischia tuberosity	Head of fibula	Tibial portion of sciatic nerve	Knee flexion hip extension
Sartorius	Anterior superior iliac spine	Medial surface of tibia, close to tibial tuberosity	Femoral nerve	Knee flexion Hip flex, ABD, ER
semitendinosus	Ischia tuberosity	Proximal, medial surface of tibia	Tibial portion of sciatic nerve	Knee flexion Hip extension
Semimembranosus	Ischia tuberosity	Posterior surface of medial condyle of tibia	Tibial portion of sciatic nerve	Knee flexion Hip extension
Gracilis	Body and inferior ramus of pubis	Tibial proximal medial surface	Obturator nerve	Knee flexion Hip flex, ADD
Gastrocnemius	Medial and Lateral femoral condyle	Calcaneal tuberosity	Tibial nerve	Knee flexion Plantar flexion
Popliteus	Lateral condyle of femur	Posterior surface of proximal tibial shaft	Tibial nerve	Knee flexion

Table 1 Muscles of the knee joint (1)

2.2 Kinesiology of the knee joint

The motion of the whole knee joint complex is characterized primarily by the flexion and extension of the tibiofemoral joint. However, this apparently simple knee motion involves complex three-dimensional motion of the tibiofemoral joint. In addition, normal knee motion depends on the motion of the patellofemoral joint. When it comes to range of motion (ROM) in general the knee joint ROM is from 120° to 150 ° degrees in flexion to about 5°-10° in extension beyond the straight 0° position. These numbers can be diverse according to authors and literature, also factors as age, gender, weight, and sex plays a rule in ROM. Also internal and external rotation also occur while the knee in slight flexion. It is called axial rotation as the axis of this motion is longitudinal. The flexion of the knee play a major role in rotation of the knee. The more flexion the less rotation. When the knee is in 90° of flexion, the rotation ROM is 30° to 40° externally which is more than twice the internal rotation ROM the goes to 10-15°. In the sagittal plane, the femur's articulating surface is convex while the tibia's in concave. Knee arthrokinematics is based on the rules of concavity and convexity and is described in terms of open and closed chain. The open kinetic chain happens during knee extension, tibia glides anteriorly on femur. More precisely, from 20° knee flexion to full extension, tibia rotates externally. During knee flexion, tibia glides posteriorly on femur and from full knee extension to 20° flexion, tibia rotates internally. Closed kinetic chain happens During knee extension, femur glides posteriorly on tibia. From 20° knee flexion to full extension, femur rotates internally on stable tibia. During knee flexion, femur glides anteriorly on tibia and from full knee extension to 20° flexion, femur rotates externally on stable tibia. (7,18)

The term (locked knee) known as the position of zero flexion, it makes all of the structures inside the knee joint in a solid contact and hold the knee stable in this position. and the term (unlocking the knee) happens while movement of the tibia rotating slight laterally during the first 5° of flexion. (7,18)

2.3 Biomechanics of the knee joint

The knee allows locomotion within minimum energy requirements from the muscles and provide stability for accommodating for different terrains. It has a biomechanical role in providing gait by flexing and rotating and at the same time, gives stability during ADL. It shortens and extends lower limb as required and transmits forces across it. It also functions to transmit, absorb and redistribute forces caused during ADL. The joint produces functional shortening and lengthening of extremity. The knee is comprised tibiofemoral joint and patellofemoral joint. (6,7,19)

When it comes to load bearing, stability, joint lubrication, prevent capsule, synovial impingement and shock absorbers at the knee joint, menisci are the taking role of that at the joint. As the femur compresses through the meniscus onto the tibia, it pushes the meniscus out of the joint cavity. The meniscus deforms to conform with the femoral condyle and allows for the contact to be distributed over a larger area. Also, the meniscus increases its circumference and moves radially outwards and posteriorly with knee flexion, following the rolling and sliding of the femoral condyle with flexion. During radial deformation, the meniscus is anchored by its anterior and posterior horns. While during loading, tensile, compressive, and shear forces are generated. (12,19)

The knee joint is a modified hinge joint with gliding function too. It has got six degrees of freedom 3 rotations and 3 translations. In sagittal axis it has flexion-extension movement, in frontal axis, it has a varus-valgus rotation and whereas in transverse axis there is internal-external rotation)

- Flexion-Extension: 3 degrees of hyperextension to 155° of flexion
- Varus-valgus: 6°-8° in extension
- Internal-external rotation: 25° - 30° in flexion
- Translation
 - Anterior-posterior: 5–10 mm
 - Compression: 2–5 mm (patellar compression)
 - Medio-lateral: 1-2 mm

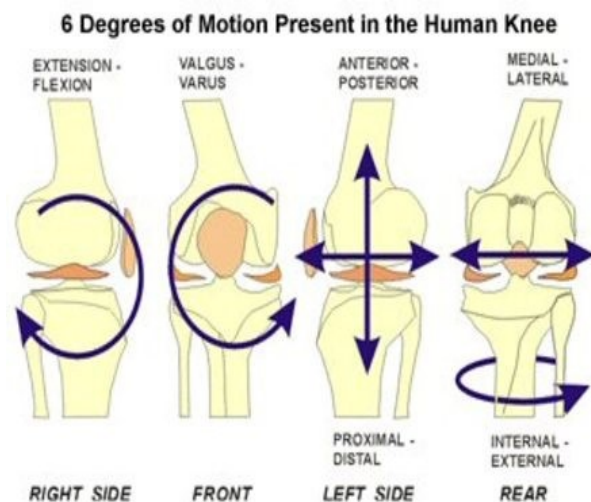


Figure 3 Degrees of motion in the knee joint(19)

Anatomic axis of the knee

A line is drawn along the shaft of the Femur and shaft of tibia form angle of 170° to 175° degree. When the angle is less than 165° an abnormal condition called genu valgum. This subjects the medial aspect of the knee is subjected to distraction force. When the angle is more than 180° an abnormal condition called genu varum. The medial aspect of the knee is subjected to Increase compression loading. (26)

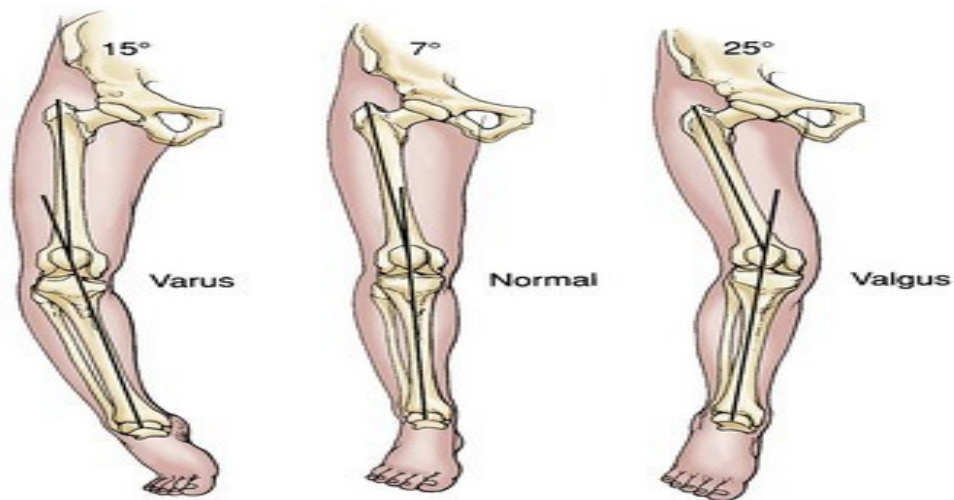


Figure 4 Degrees of motion in the knee joint (26)

2.4 Knee Osteoarthritis (OA)

2.4.1 Character and Etiology

Osteoarthritis is a chronic non-inflammatory disease involving movable joints which is characterized by being progressive cartilage degradation, bone remodelling, osteophyte formation, joint inflammation and loss of normal joint function. Affects mostly the synovial joints which function as weight bearing joints. Osteoarthritis is the most common form of arthritis, appears with ageing that causes appreciable disability in high percentage of older adults, and it is more prevalent in female than male. younger ages also could have it after an injury. The causes are classified to a primary or idiopathic with no evident cause, or one that has origin is more clearly defined predisposing pathology. (11,23)

The most prominent feature of any synovial joint with osteoarthritis is the fraying and loss of cartilage. The fraying of the superficial cartilage reduces the ability of the bone ends to glide over each other, which often results in the bone feeling stiffer and occasionally sticking during movement. The loss of cartilage reduces the distance between the bone ends which means the ligaments are often less taut so that the joint often feels unstable. OA of the joint does not just affect the cartilage but affects all the different structures of the joint. (11,23,29)

2.4.2 Kellgren and Lawrence system for classification of osteoarthritis of knee

The common method of classifying the severity of knee osteoarthritis (OA) is by The Kellgren and Lawrence system using five grades with the assistance of the radiographic images. This classification was proposed by Kellgren et al. in 1957² and later accepted by WHO in 1961.⁽⁴⁾

- grade 0: no radiographic features of OA are present
- grade 1: doubtful joint space narrowing and possible osteophytic lipping
- grade 2: definite osteophytes and possible joint space narrowing on anteroposterior weight-bearing radiograph
- grade 3: multiple osteophytes, definite joint space narrowing, sclerosis, possible bony deformity

- grade 4: large osteophytes, marked joint space narrowing, severe sclerosis and definite bony deformity



Figure 5 Grades of osteoarthritis of knee joint shown in an X-ray(3)

2.4.3 Epidemiology

Osteoarthritis is the single most common cause of disability in older adults. The 2010 Global Burden of Disease Study reports that the burden of musculoskeletal disorders is much larger than estimated in previous assessments and accounts for 6.8% of DALYs worldwide. An estimated 10% to 15% of all adults aged over 60 have some degree of OA, with prevalence higher among women than men. Across the EU Member States, diagnosed OA prevalence varies from 2.8% in Romania to 18.3% in Hungary. (27)

The prevalence of OA is increasing due to population ageing and an increase in related factors such as obesity. According to the United Nations, by 2050 people aged over 60 will account for more than 20% of the world's population. Of that 20%, a conservative estimate of 15% will have symptomatic OA, and one-third of these people will be severely disabled. This means that by 2050, 130 million people will suffer from OA worldwide, of whom 40 million will be severely disabled by the disease. Costs associated with OA include costs for adaptive aids and devices, medicines, surgery, and time off at work. (27)

2.4.4 Risk factors

The risk factors of OA are starting by age as its probably the most obvious factor as its uncommon in young ages, and for 2 reasons age is a risk factors, the first is inability of the body to repair the cartilage, the 2nd is change in fitness and activity levels. Although the prevalence of osteoarthritis increases sharply with age, there are still some people who do not develop it. (11,23,27)

Genetic factors that was first realized for hand OA when doctors noticed that most patients had a family member with the same condition. It is very unlikely that there is a single gene that determines the genetic risk, but rather a large number of genes. However, there are other important risk factors for developing osteoarthritis and these may modify our genetic risk of developing OA. (11,23,27)

Injury can be a risk factor for developing osteoarthritis in later years. Acute injuries such as meniscal cartilage and anterior cruciate ligaments in the knee tears and dislocations increase the risk of osteoarthritis in later years in the joint. (11,23,25)

Repetitive movements or strains on joints are one of the common factors, like athletes who train at very high and intense levels causing extra stress to joints, it also appears in some people due to their jobs or cultures. (11,23,25)

Obesity is a major factor of many diseases such as heart disease and diabetes, but when it comes to OA it's a direct cause of it, as the extra weight increases the stress on the joint mostly the hip and knee joint. Obesity is the most common factor of developing OA. (11,23,25)

There are other factors such as gender in which its in equal numbers until the age of 55, but after that age, females are twice likely to develop OA. Bone density is also linked to OA, the higher the density the higher the risk. Nutrition is also a factor, vitamins included in our diet such as vitamin C, D and E are required for the health of the joints. When it comes to ethnic groups, its present in all of them, but depends on how many risk factors the lifestyle of the ethnic group includes. (11,23,25)

2.4.5 Clinical picture

Patients typically present with common symptoms that are insidious, chronic, and gradually worsening. In early stage, the pain can get aggravated when the joints are used and it relieves during resting. Clinical picture includes pain and stiffness in joints, worsened with activity and relieved by rest but also could appear at night rest as protective muscle splinting mechanism are disabled. In further stages the appearance of osteophytes, micro fractures, synovitis and other, it becomes constant pain. Pain tends to worsen throughout the day, whereas stiffness tends to improve also results in deformity and a reduced range of motion. (4,11,23)

While examination, inspect for deformity, there are some common characteristic findings depending on the joint affected, such as swelling, and fixed flexion deformity or varus malalignment in the knees. Feel for crepitus throughout the range of movement. Movement of the joint is generally reduced. (4,11,23)

2.4.6 Diagnostics methods

The diagnosis of osteoarthritis can't be defined by a singular sign, symptom or a test result. The diagnosis should be a result of several factors considered and the presents of the characteristic signs and symptoms of osteoarthritis including the results of X-rays and laboratory tests. Based on the symptoms and signs you present with. X-rays to confirm this diagnosis.

To diagnose first is physical examination is to look for the signs of OA. It includes the examination of joint function. Also check for joint swelling, abnormalities in range of motion, tenderness and bony outgrowths. also detect if there is changes in joint alignment or a loss of muscle mass around the joints. (4,5,11,23)

X-rays are commonly used making a diagnosis of OA, although there is often a incongruity between the severity of symptoms and the results of X-rays in people with osteoarthritis. Also not required for every case who presents with symptoms consistent with osteoarthritis. Only patients whose clinical history or course suggests other conditions should undergo radiographic evaluation. Even the presence of positive radiographic findings does not guarantee that an osteoarthritic joint is present. (4,5,11,23) Osteoarthritis of the knee has diagnostic criteria includes the following:

- knee pain
- Age older than 50 years
- Morning stiffness lasting less than 30 minutes
- Crackling or grating sensation
- Tenderness of the knee bones.
- Enlargement of the knee bones.
- Not detectable warmth of the joint to the touch.

2.4.7 Non- operative treatment for Patient with Gonarthrosis

The earlier stage patient is diagnosed of Gonarthrosis, the more physiotherapy could be helpful. The physiotherapy will start with Education as it is a chronic condition for which self-management plays a very important role. Physiotherapy goal is to benefits the whole body by correcting posture and gait, treat the musculoskeletal asymmetry to physiological state and the use of physical therapy treatments and modalities. Physiotherapy recommends Gonarthrosis patients with over-weight to lose which would decrease the stress on the joints. (17,20,25,29)

Its recommended also do a program of Exercises helps increasing the aerobic capacity, the muscle strength and the endurance, and also help to weight loss. The use proprioceptive and sensomotoric exercises helps improving the stability and movement. Quadriceps strengthening exercises have been demonstrated to lead to improvements in pain and function. By using Active and passive ROM exercises, stretching exercises for hamstrings and gastrocnemius. (17)

The use of Soft tissue technique(STT) is also one of the physiotherapy methods to treat patients of Gonarthrosis. To apply STT physiotherapist could use the soft ball, fascia shitting and massage. STT Improves the blood circulation and nutrition supply of treat side which is recommended to apply to the joint and also the whole lower extremities and lower back to improve the blood circulation which help realising restrictions of the skin or subskin around the joint. (17)

Joint play(mobilization) is recommended for Gonarthrosis patients who have joint are restricted or stiff. patients commonly have a restricted patella, tibiofemoral joint, which also effects the foot joints to also be stiff as subtalar, talocrural joints and the motion of quadriceps muscle. (10,17)

Hydrotherapy is beneficial for OA patients, they find it is easier to move in water. In swimming pool patients can perform a programme of exercises to improve their mobility. Patients find the feeling of warmth and less weight-baring makes it easy to move with low effort and as a result the joints and muscles relax. OA patients involving joints of lower limbs exercising in water is recommended. Thermal therapy is useful for OA patients using icepack placed on a painful joint, it could bring considerable relief. They also reduce local inflammation and relieve pain. TENS electrotherapy applied directly around the knee to help decreasing the pain. (17,20)

2.4.8 Pharmacological treatment

Pharmacology offers the following for OA patients:

- Simple drugs (analgesics) like paracetamol
- Pain relieving drugs (analgesics):
 - Non-steroidal anti-inflammatory drugs (NSAIDs) can be considered for those who respond inadequately to paracetamol. However, there are certain disadvantages in routinely using NSAIDs in OA
 - Opioid analgesics are useful alternatives in patients in whom NSAIDs are not suitable, ineffective and/or poorly tolerated.
 - Formulations of NSAIDs that can be applied to the skin (gel).
 - Other medicines include amitriptyline and capsaicin.
 - symptomatic slow-acting drug (SYSADOA).
- Intra-articular injections. This is an injection into the joint, and it causes considerable pain relief in joints with osteoarthritis.
- Vitamins and supplement C, E and D, after consulting a nutritionist if needed. (11, 29)

2.4.9 Surgical treatment

Although most OA patients do not need a surgery, it could be a last option for the patient having severe joint damage, extreme pain or very limited motion of the joint as a result OA and the conservative therapies have results were insufficient. Deciding to go through surgery depends on several factors including the patient's level of disability, the intensity of pain, the interference with their lifestyle, age, other health defects and their occupation. Most of the surgeries performed for osteoarthritis to replace the hip or knee joint have been successful. Orthopaedic surgeon could assist patient in deciding if surgery is necessary to relieve the pain from osteoarthritis. (11,13,14)

The surgery is performed to remove loose pieces of bone and cartilage from the joint in case it is causing mechanical symptoms of locking, to resurface (smooth out) bones, to reposition bones (osteotomy), and replace joints.

There are several types of joint surgeries, starting by Arthroscopy, or 'scoping' a joint, is an outpatient procedure that is used to examine and sometimes repair joints. For

arthroscopy, the doctor inserts a viewing tube (an arthroscope) through a small cut (about 5 mm) into the fluid-filled space in the affected joint. The technique is used to help diagnosing or to carry out treatment or keyhole surgery using miniaturized instruments. The surgeon clears away debris and smooths damaged cartilage in the knee. (11,13,14)

Osteotomy surgery is another type of surgery used for the knee to realign bones axis and other joint structures that have lost the physiological alignments. The realignment goal to help shifting the weight-bearing to healthier side of the cartilage where the joint has been less or not damaged by the osteoarthritis, it could result to pain relief. The procedure is done to relieve stress on the cartilage and prevent further damage to the joint. Cartilage transplantation surgery is also an option in which surgeon goal is to graft new cartilage cells into damaged regions of cartilage. The benefit of this type of surgery still being studied. (11,13,14)

Joint replacement surgery is done to replace a damaged joint with an artificial joint. Knee and hip replacement are often the most common indication, almost 85% of all cases. The rest of the are used to replace the joints of shoulders, elbows, fingers, ankles and toes. The study case patient is 7 days after total knee replacement and it would be detailed. (13,14)

2.5 Total knee replacement

To undergo the joint replacement surgery, the patient should have radiographic evidence of joint damage, and the presents of moderate to severe constant pain failed to be relieved by using the non-operative treatment options, and functional limitation affects ADL and quality of life.

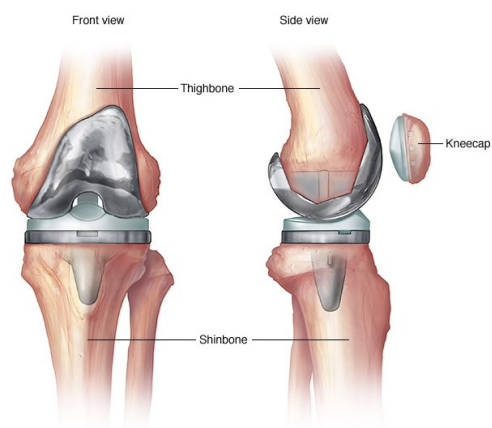


Figure 6 Artificial knee joints (30)

During the surgery the surgeon starts by removing all the damaged bone and cartilage out of the joint. To replace affected joints with artificial joints known as prostheses. These joints can be made from high-density plastic, metal alloys and ceramic material. Depending on patient's weight age, activity level and other medical conditions

surgeon would decide what design and components of prostheses to choose. It is also possible be joined to bone surfaces by special cements. There is a chance that Artificial joints would wear out and about 10% of artificial joints may need replacement later. (13,14)

2.5.1 Pre-surgery rehabilitation

The pre-surgery rehabilitation prepares the patient for surgery, to help accelerate the recovery time. Starting by education of the patient to prepare for the post-rehabilitation statue, such as verticalization from bed, prevention of thromboembolism, contraindications, self-therapy, and last how to use crutches. Also correcting posture and gait training takes part of pre-surgery rehabilitation. Strengthening exercises is highly recommended as its help accelerating the healing time and reduces muscle imbalance. (13,14,17)

2.5.2 Post-surgery rehabilitation

The post-surgery rehabilitation is similar to the non-operative treatment using STT, joint mobilization, active and passive ROM exercises, hydrotherapy and thermotherapy. Post-surgery rehabilitation should start from the first day. Continuous passive motion (CPM) machine is commonly used after the surgery to help restore ROM with the help of daily exercises and application of post isometric relaxation(PIR). Correcting gait while using crutches during walking and using the stairs. Scar care also is applied when the stitches are removed. Before leaving the rehabilitation department the physiotherapist should aware the patient of the changes caused by the limitations in their ADL and helps them to adapted the change. (13,14,17)

3 Case study

3.1 Methodology

My bachelor practice took place in Oblastní nemocnice Kladno in Kladno. This practice started on 4th February 2019 and ended on 15th February 2019, a 10 days practice. Each day had a duration of 8 hours. The total amount of hours of practice was 80 hours. My clinical work placement was supervised by Mgr. Ilona Kučerová. The number of the sessions with my patient was fourteen.

The therapeutic procedures were applied in an individual therapy and exercise room. In the therapies, we used soft tissue techniques, fascia techniques, joint play mobilization, muscle relaxation, stretching, and strengthening techniques, sensomotoric and proprioceptive exercises, and general exercising. For the examinations, I also used instruments such as a goniometer, measurement tape, neurological hammer, vibration fork and plumb line.

My work has been approved by the Ethics Committee of the Faculty of Physical Education and Sport at Charles University. The approval can be found in the page 80.

3.2 Anamnesis:

- Examined person: J. D.
- Sex: Male age: 50
- Diagnosis: Right knee replacement after the diagnosis of osteoarthritis
- Code: ICD-10: Z47.1 after total knee replacement

Status presents:

Objective

- Height: 166cm
- Weight: 69Kg
- BMI: 25.0

Subjective:

50 years old male patient, transferred from the orthopaedic department of Na Františku Hospital to the rehabilitation department of Kladno's Hospital. Patient came by his own to the treatment room with no assistant required using crutches feels good today, he had pain around his right knee during the night. Pain scale today 6/10

History of present problem:

The patient had history of pain and stiffness during his daily activities. Until he had medical checks and Rheumatology testing for his knee joints, the diagnosis of knee osteoarthritis was present, and total knee replacement is indicated for the right knee.

On 06.02.2019 patient arrived to the department, 7 days after his total replacement of the right knee. The patient has no bandage over the scar with stitches. Operation of right knee is his first hospitalization has 4/10 pain in the right knee. there is a swelling around the operated knee. he has trouble sleeping during the night due the pain. He will begin the rehabilitation today and end it after two weeks.

Family Anamnesis:

- Patients family had No history of rheumatic disease.

Operation Anamnesis:

- It was done on .28.01.2019 by the orthopaedic department of Na Františku Hospital.

Allergies Anamnesis:

- None.

Medications and pharmacological Anamnesis:

- Xarelto
- sertalin
- codein
- Zoloft

Occupation Anamnesis:

- Truck driver (still working).

Social Anamnesis:

- Married, He lives with his wife. On 1st floor apartment, no kids.

Past and current sports, regular physical activities and hobbies:

- Playing football.
- Walking.

Abuses:

- None.

Previous injuries:

- None.

Prior Rehabilitation:

On 28.1.2019 Post operation care before he was transferred to rehabilitation department of Kladno's hospital.

Excerpt from patient's health care file:

Files shows Diagnosis of primary osteoarthritis (Gonarthosis) of knee, also previously was diagnosed depression. And he had history of epilepsy in childhood.

Rehabilitation Indications (from health care file):

- The use of CPM (continues passive movement motor).
- Cold packs for the right knee.
- Scar care.
- Improve Joints movement and mobility to the physiological level.
- Walking.

3.3 Initial Kinesiological Examination by physiotherapist:

Postural Examination

Posterior view (With crutches. Without plumb line) According to Kendall:

The base of support:	Narrow base support also shows signs of hip joint external rotation
Shape and position of the ankle joints:	Symmetrical in shape and position
Shape and thickness of the Achilles tendons:	Achilles tendon is slightly valgus on both side
Contour of the calf muscles:	The right calf has a edema and has signs of Hypertrophy
Shape and position of the knee joints:	The right knee is swollen
Popliteal line:	popliteal lines are in external rotation on both side
Gluteal muscles:	Symmetrical in shape and position
Symmetry of the thoracobrachial triangles:	Symmetrical
Position of the pelvis:	Symmetrical slight external rotation of the hip joint.
Paravertebral muscles:	No abnormality
Curvature of the spine in the frontal plane:	There is no visible curve
Position of the scapula:	Right scapula is abducted
Weight distribution:	Weight is loaded more on the left side
Position of the shoulder girdle:	The right side is higher
Position of the upper limb:	Symmetrical , in a slight abduction
Position of the head:	The back is slightly bended forward at the level of the Th

Table 2 Postural examination Posterior view

Anterior view According to Kendall:

The base of support:	Narrow base support also shows signs of hip joint external rotation
The position of the feet	The right foot (operated side) doesn't have a full contact with the floor. As the left one
The position and the shape of toes	Symmetrical in position and shape
Weight disruptions	Weight is loaded more on the left side
Shape and position of the knee joints:	The right knee is swollen also Slight external rotation of both patella joints,
Configuration of the tibialis anterior muscle:	Slightly Asymmetrical due to swelling of the operated side
Contour of the anterior compartment muscles of the lower leg:	Right side is not visible because of the swelling of the right side
Position of the pelvis:	Symmetrical
Muscle tone symmetry of the abdominal muscles:	Although its Slightly visible , its Symmetrical
Position of the umbilicus:	Umbilicus slightly shifted to the right
Symmetry of the thoracobrachial triangles:	Symmetrical
Position and symmetry of the chest:	Symmetrical with no deformities
Position of the sternum:	Optimal with no sign of rotation
Position of the shoulder girdle:	
Position of the upper limbs:	Symmetrical Shoulders are slightly abducted
Position of the head:	Optimal, No sign of rotation

Table 3 postural examination Anterior view

Lateral view According to Kendall:

Weight distribution	More load is on the lateral aspect of the foot on non-operated side
Shape and position of the ankle joints	Planter flexion of the right side while left is slightly pronated
Shape and contour of the shin	Symmetrical
Position of the knee joints	Left is in hyperextension , Right is in semi flexion
Contour of the thigh muscles	Elbow is semi flexed (crutches position)
Position of the pelvis	Slightly tilted forwarded
Position and curvature of the spine	Physiological curve of all components
Shape of the abdominal muscles	Not bulging out , not frame
Position of the shoulder girdles	Protraction of the shoulders on both sides
Position of the head	Slight Protraction of the head

Table 4 Postural examination Lateral view

3.3.1 Anthropometrical measurement according to Skylab Crewmen:

Part	Sin.	dx.
Thigh	51 cm	44 cm
10cm above the patella	46.5cm	42cm
Over the patella	38cm	41cm
Around the patella	39cm	40cm
under the patella	34cm	33cm
Calf	35,5cm	34cm
Ankle	23.5cm	23cm
Around meta tarsals	76.2 cm	76 cm
Anatomical length	85.5 cm	85.5 cm

Table 5 Initial examination, Anthropometrical measurements

3.3.2 Aspection:

He has a 16 cm long scar on the right knee. There is edema/swelling in his right knee and his leg just around the right knee specially caudally.

there was no sign of hematomas, and Right knee is in semi flexion, restricted to full extension.

3.3.3 Palpation

Muscle tone:

Muscle	Sin.	Dx.
Semitendinosus	Hypertonic	hypertonic
Semimembranosus	hypertonic	hypertonic
Rectus femoris	hypertonic	hypotonic
Vastus medialis	hypotonic	hypotonic
Vastus lateralis	Normal tone	Hypotonic
Vastus intermedius	Normal tone	Hypotonic
Biceps femoris	Normal tone	hypertonic
Abductors of hip	Normal tone	hypertonic
Piriformis	Normal tone	Normal tone
Quadratus lumborum	Normal tone	Normal tone

Table 6 initial Muscle tone

Skin:

Skin of the anterior part of the right knee is restricted in all directions also had increased temperature than the left one.

Skin of the anterior part of the calf is also restricted

Sub-skin and fascia:

Generally, there wasn't any restriction on the left side of The upper leg, The lower leg and the Achilles tendon. The right thigh and calf had a higher restriction, the closer parts to the knee the more restriction is present.

3.3.4 Pelvic palpation Examination

Iliac crest	Right is slightly higher
ASIS	Right is slightly higher
PSIS	Right is slightly higher

Table 7 Initial examination, Pelvic examination (According Kendall)

3.3.5 Length test (According Janda)

Muscle	Sin.	dx.
Hip flexors one-joint muscles	0	1
Hip flexors two-joint muscles	1	1
Adductors one joint	0	0
Adductors two-joint	0	0
hamstring	1	1
Gastrocnemius	0	n/a

Table 8 Initial examination, Length test

3.3.6 Range of motion Examination

(According Kendall)

Active ROM

Hip Joint		
Plane	Sinister	Dexter
S	10°-0°-100°	10°-0°-95°
F	45°-0°-15°	35 °-0 °-15 °
R	50°-0°-15°	30 °-0 °-15 °

Knee Joint		
Plane	Sinister	Dexter
S	0 °-0 °-130°	0 °-5 °-70 °

Ankle Joint		
Plane	Sinister	Dexter
S	40 °-0 °-10 °	45 °-0 °-10 °
R	20 °-0 °-30 °	20 °-0 °-30 °

Table 9 Initial examination, Active Range of motion (According Kendall)

Passive ROM

Hip Joint		
Plane	Sinister	Dexter
S	15°-0°-115°	15°-0°-105°
F	45°-0°-20°	35°-0°-20°
R	50°-0°-25°	35°-0°-20°

Knee Joint		
Plane	Sinister	Dexter
S	0°-0°-130°	0°-5°-70°

Ankle Joint		
Plane	Sinister	Dexter
S	40°-0°-10°	45°-0°-10°
R	20°-0°-30°	20°-0°-30°

Table 10 Initial examination, Passive motion (According Kendall)

3.3.7 Gait Examination

Walks with crutches (3-point Gait)

Width of the base of support	Narrow
Walking rhythm	Slow gait
Stride length	Right foot is shorter
Movement of the foot	
<ul style="list-style-type: none"> • Heel strike 	Optimal on left absent on the right
<ul style="list-style-type: none"> • Flat foot 	Presented on left
<ul style="list-style-type: none"> • Loading response 	absent on the right side
<ul style="list-style-type: none"> • Heel off 	Optimal on left absent on the right
<ul style="list-style-type: none"> • Toe off 	Optimal on left absent on the right
Movement and position of the knee and hip	On left is optimal , on right movement of the knee is absent
Position and movement of the pelvis	Slight tilted pelvis with no sign of drop
Movement of centre of gravity	Patient is stable most of his gait
Position and movements of the trunk	Slightly bended forward during the movement
Position of the spine	No sign of rotation
Activity of the back muscles	Normal activity
Activity of the abdominal muscles:	Normal activity
Position of the shoulders	Slightly protracted
Position and movements of the head	Slightly protracted
Movements of the upper extremity	Movement is presented using the crutches
Stability of walking	

Table 11 Gait examination

3.3.8 Strength test:

(According Kendall)

Muscle	Sin	dx
Quadriceps femoris	5	3 with limited ROM
Iliopsoas	5	5
Hamstring	5	3
Gluteus maximus	4	3
Hip Adductors	4	4
Hip Abductors	5	3
Tibialis anterior	5	4
Triceps surae	5	5

Table 12 Initial examination, Strength test

3.3.9 Movement stereotypes (according to Janda)

Hip extension:

Movement pattern on right hip:

1. Gluteus maximus (ipsilateral)
2. Hamstrings (ipsilateral)
3. Spinal extensors lumbar(contralateral)
4. Spinal extensors lumbar(ipsilateral)
5. Spinal extensors thoracic(contralateral)
6. Spinal extensors thoracic (ipsilateral)
7. Shoulder girdle (ipsilateral)

Movement pattern on left hip:

- Hamstrings (ipsilateral)
- Spinal extensors lumbar (contralateral)
- Spinal extensors lumbar (ipsilateral)
- Gluteus maximus (ipsilateral)
- Spinal extensors thoracic (contralateral)
- Spinal extensors thoracic (ipsilateral)
- Shoulder girdle (ipsilateral)

Hip abduction:

Altered pattern on both legs: patient does have clean abduction with no rotation or flexion on the left side. While right one

3.3.10 Neurological examination:

Higher function: physiological

Position sense: physiological

Sensations of dermatomes in lower extremity with light touch: physiological

Deep tendon reflexes: physiological

Examination of pain: pain on the right knee region of L4, L5, S1, S2 dermatomes

3.3.11 Joint play examination (According Lewit):

Joint	Sin	Dx.
Patella	No restriction	Restriction caudally
Fibular head	Stiff caudally	Blocked in all direction
Talocural	No restriction	No restriction
Subtalar	No restriction	No restriction
Chopart	Stiff/restricted	No restriction
Lisfrance	No restriction	No restriction

Table 13 Initial examination, Joint play examination

Table 13. Initial examination, Joint play examination

MTP: slightly stiff at the left foot.

PIP: No restrictions

DIP: stiff

The right fibular head is blocked in all direction, while the left one is just stiff caudally.

Slightly stiff metatarsals and distal interphalangeal (DIP) joints of both feet but not blocked.

3.3.12 Examination's conclusion

The Anthropometrical measurements results showed that there is a difference between the operated leg and the healthy leg. The right leg (the operated) is swollen, mostly around the knee. The right calf is 1,5cm is less in circumference. Under, over and around the knee the right is bigger than the left, but 10 cm above the patella the left (non operated) is bigger. This is telling when the swelling in the right leg is treated, and the muscles start to recover, it will make up the difference. last The lengths are symmetrical in both extremities anatomically and functionally.

Also at aspection examination shows us mainly the 16 cm scar with stiches without bandage, dry scar with stiches. Also there are no signs of hematomas around the operated knee... We can also tell that the right knee is semi flexed. While he is standing or even in bed. Also patients both hip joint at remarkable external rotation while on bed.

The palpation of the muscles result is that the right leg is mostly in hypotrophy with hyper tone, and with trigger points. The left leg is in physiological tone. Also there was pain while plating the anterolateral part of right tibia.

Skin on right leg has increased temperature, there is pain from under the patella and caudally. also there is a stiff soft tissue posterior to the patella, had to consult the doctor, the Doctor have described it as “fibrosis”

Left leg is physiological, has no pain. The subskin and fascia is physiological on the left leg, but in the right its restricted. Both the superficial deep layers are restricted in the thigh and calf.

The result from the length test was physiological at most of the joints that tested, but both legs has shortness in the 2 joints muscles of iliopsoas M. and hamstring muscles, The left leg was physiological, no shortness apart of iliopsoas M. and hamstring.

The examination of ROM shows that there is decreased range of motion in the right lower extremities compared to the left one. As it is expected after a total knee replacement, there would be restriction in range of motion into flexion, the right knee can only be flexed actively 70° and passively 80°, which is expected after this type of surgery. The extension is also restricted in the right leg.

Also the results show patient has signs of hypermobility at the ankle and foot joints.

The most important goal of the therapy. Is to improve the range of motion as the patient strength level is increasing.

Patients has typical posture of a patient after knee replacement surgery, notable narrow base support, semi flexed operated side, hyper flexed non operated knee joint,

which would affect the hip and upper extremities posture, also the use of crutches (3point gait) change the posture of the patient due asymmetry of weight bearing.

The pelvic examination result shows the right side is higher in areas (PSIS and Crests). using the crutches could be the reason, were the patient leans over to the left side for compensating for the pain, so that he is elevating the right pelvis.

In gait examinations walking with crutches, properly done, but he has a slow gait with a short step length on right side, and longer one on the left side.

He has no pain while walking which is good. he is putting more weight on the left leg, due his inability to weight bearing. The lower trunk motion is stiff due to the crutches; his upper trunk doesn't rotate. His heel strike is landing first and then rolling over the whole foot, ending on the toes.

He shows high strength in the whole left extremity. The right leg is weak in the quadriceps femoris, hamstrings, gluteus maximus and adductors. The quadriceps femoris, the adductors and the hamstrings are the weakest with 3 on Kendall's scale. The rest are physiological,

The weakness seems because of the surgery, and limited activity for the last days. Restoring the muscle strength is a priority goal leads to improve the range of motion to the restricted joints.

The movement stereotype of the hip abduction showed a physiological result. But not at hip extension. It was not physiological and had also different pattern at each leg.

Neurological examination had physiological results in all dermatomes. But he has pain in the dermatomes L4, L5, S1 and S2 in the area of the right knee. Deep tendon reflexes are also physiological on both legs.

All the MTP joints were stiff but weren't blocked in all joints. The PIP and DIP joints were also stiff in all directions but not restricted. The patella of the operated leg was blocked in caudal directions.

3.4 Rehabilitation plan

3.4.1 Short-term physiotherapy plan:

- Decrease pain at the operated knee.
 - Reduce the edema/swelling of the operated knee.
 - Restore the range of motion of the right knee joint.
 - Stretch the shorted muscles of the lower extremities.
 - Strengthen The right Tibialis anterior, right Hip Abductors, both Hip Adductors, both Gluteus maximus, right Hamstring and right Quadriceps femoris
 - Mobilize the blocked joints right Patella, both Fibular head and left Chopart.
-
- The active ROM in the right knee should be up to 90-100° flexion
 - The extension should be 0° after the 2 weeks' treatment plan. The tense and short hip flexors, adductors and hamstrings should be stretched and relaxed.
 - Hip flexors, hip extensors and adductors of the right leg should be the main focus in the strengthening exercises, since these muscles groups was most effected after the operation. The blocked patella should be mobilized and also the stiff PIP, DIP and MTP joints. Re-educate the gait (stairs and normal), improve the stability and balance.

3.4.2 Long-term physiotherapy plan

- Improve the patient functionality.
- Increase the strength of weak muscles.
- Restore stability.
- Improve balance.
- Restore full range of motion.
- To improve the general ADL function.

3.5 Therapy sessions

3.5.1 1st day 6.2.2019

Objective:

7 days after the surgery, patient came by his own to the therapy room walking with crutches (3point gait) feeling good to start the therapy.

Subjective:

Today's therapy started by patient knee flexion of 70 ° of passively, and 60 ° actively. With the starting position of 10 ° into extension. S:0-10-70 passive, S:0-10-60 active. Also patient have a scar of 16cm with stitches, the scar is dry.

Goals of today's therapeutic unit:

- Prevention from deep vein thrombosis.
- Reduce post-operative pain and edema in the knee joint and muscles.
- Post-operative scar scare.
- Release tension from soft tissues with soft tissue techniques, by Lewit in right thigh, calf and increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps femoris (lateral head), adductors of the, abductors.
- Increase ROM in right hip and knee joints (F, E), and ankle joint PF and DF, in passive and active movements.
- Training of transitioning positions.
- Gait training to restore mobility of knee joint during the gait and keep up the activation of lower extremities muscles.

Procedures:

- Soft tissue techniques (by Lewit) applied on right thigh using hand and soft ball, right thigh, knee region and calf in all directions.
- Scar therapy has been done by the mobilization of the scar tissue carefully as it's

still with stiches and also mobilization of the soft tissue surrounds the scar.

- Exercises in supine and seating position: dorsal flexion and plantar flexion of the ankle joints and circumduction repeat and change to opposite circumduction. Duration of 5 minutes, repetitions each hour. Isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.
- Supine on bed active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times.
Also adduction and abduction movements of hip joint. Repeat 7 times. Also active movements and with resistance dorsal flexion and planter flexion of the ankle. Repeat 7 times.
- Stretching PIR (by Lewit) for the right adductors m., hamstrings m., Rectus Femoris M., and tensor fasciae latae 3 times for each.
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Control of transitioning positions (from supine to prone, to side and from bed to standing).
- Passive Stretching for right adductors muscles of the leg and right Rectus Femoris muscle.
- Treatment of trigger point on the right adductor region.
- Isometric exercises with use of softball for the right quadriceps m.
- Mobilization of the right head of fibula and right cuboid.
- Application of device CPM for the 30 minutes with settings on F:90 degrees and E:5 degrees.

Results:

Objective:

After the first session the patient felt tired with no pain but just at the operated knee joint, but he was feeling better than before and his performance of exercises was motivated and giving effort also transitioning of positions with no great effort and patient is aware of himself.

Subjective:

There wasn't noticed change in ROM after today's session. But there was a slight release of tension after the application of soft tissue techniques on right thigh, calf (anterior, posterior side) in all directions. Joint play results the right head of fibula joint and chopart's joint still has stiffness in all directions.

Self-therapy:

- Actively flexion of hip joint along to help with flexion of the knee joint. Repeated 7-10 times.
- Rolling of the foot with help of exercise ball to provide knee flexion.
- Breathing exercises were instructed too. he was told to raise both arms, breathe deeply and release. Repeat 5-6 times daily.

3.5.2 2nd day 7.2.2019

Objective:

After the use of CPM (continues passive motion) motor for 30 min in the morning, the Patient came by his own to the therapy room walking with crutches (3point gait) feeling good and motivated to start the therapy.

Subjective:

Today's therapy started by patient knee flexion of 80 ° of passively, and 70 ° actively. With the starting position of 10 ° into extension. S:0-10-80 passive, S:0-10-70 active. Also patient have a dry scar still with stitches.

Goals of today's therapeutic unit:

- Reduce post-operative pain and edema in the knee joint and muscles.
- Release tension from soft tissues with soft tissue techniques, by Lewit in right thigh, calf and increase elasticity and extensibility.
- Continuing the scar care.
- Increase strength in weakened muscles quadriceps femoris (lateral head), adductors of the, abductors.
- To increase ROM in right knee and right hip joints in all planes in passive and active movements.
- Unblock restricted for: right patella caudally, fibular head in (both), left Chopart joint, interphalangeal joints of toes, in all the directions (both), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).

Procedures:

- Soft tissue techniques (by Lewit) applied on right thigh using hand and soft ball, right thigh, knee region and calf in all directions.
- Scar therapy has been done by the mobilization of the scar tissue carefully as it's still with stiches and also mobilization of the soft tissue surrounds the scar.
- Exercises in supine and seating position: isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.
- Supine on bed Active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times.
Also adduction and abduction movements of hip joint. Repeat 7 times. Also active movements and with resistance dorsal flexion and planter flexion of the ankle. Repeat 7 times.
- Stretching PIR (by Lewit) for the right adductors m., hamstrings m., Rectus Femoris M., and tensor fasciae latae 3 times for each.
- Joint play techniques (by Lewit) for: interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints in all the directions (both sides), dorsal and plantar fan (both sides). right patella caudally, fibular head both direction (both sides), chopart joint caudally (left sides), Interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Passive Stretching for right adductors m. and right rectus femoris muscle.
- Isometric exercises with use of softball for the right quadriceps m.
- Mobilization of the right head of fibula and right cuboid.
- Application of device CPM for the 30 minutes with settings on F:90 degrees and E:5 degrees.

Results:

After today's session the patient felt better than his first with no pain but just at the operated knee joint at night he said, His performance of exercises was motivated and giving effort as the previous day.

Self-therapy:

- Deep vein thrombosis prevention 5 min. every hour
- Pillow or soft ball under knee in bed for isometric contraction of quadriceps 10-12 repetitions, 3 times a day.
- Flexing the knee by sliding the heel on bed towards the buttocks for isotonic contraction of tibialis anterior and hamstrings 10-12 repetitions, 3 times a day.

3.5.3 3rd day 8. 2.2019

Objective:

Patient came by his own to the therapy room walking with crutches (3point gait) feeling good to start the therapy. The patient complained of pain during the night at right knee joint capsule pain scale 4/10.

Subjective:

Today's therapy started by patient knee flexion of 80 ° of passively, and 80 ° actively. with the starting position of 5 ° into extension. passive S:0-5-80, active S:0-5-80. Also patient still have a dry scar still with stitches.

Goals of today's therapeutic unit:

- Reduce post-operative pain and edema with active movements in hip, knee and ankle joints.
- Prevent thromboembolism (muscle pump exercises).
- Train transitioning positions and verticalisation.
- Release tension from soft tissues with soft tissue techniques, by Lewit in right thigh, calf and increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps, adductors, abductors and increase ROM in hip joint (F, E), in knee joint F and in ankle joint PF and DF, with active movements.
- Unblock restricted joints with Joint play techniques by Lewit for interphalangeal joints of toes, in all the directions (both), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).

Procedures:

- Soft tissue techniques (by Lewit) applied on right thigh using hand and soft ball, right thigh, knee region and calf in all directions and sides.
- Scar therapy has been done by the mobilization of the scar tissue carefully as it's still with stiches and also mobilization of the soft tissue surrounds the scar.
- Exercises in supine and seating position: dorsal flexion and plantar flexion of the ankle joints and circumduction Repeat and change to opposite circumduction. Duration of 5 minutes, repetitions each hour. Isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.
- Supine on bed Active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times. Also adduction and abduction movements of hip joint. Repeat 7 times. Also active movements and with resistance dorsal flexion and planter flexion of the ankle. Repeat 7 times.
- Stretching PIR (by Lewit) for the right adductors m., hamstrings m., Rectus Femoris M., and tensor fasciae latae 3 times for each.
- Joint play techniques (by Lewit) for Metatarsophalangeal joints in all the directions (both sides). right patella caudally, fibular head both direction (both sides), chopart joint caudally (left sides), Interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Isometric exercises with use of soft ball for the right quadriceps m.
- Application of device CPM for the 30 minutes with settings on F:90 degrees and E:5 degrees.

Results:

The patient felt better he said, also had the motivation to perform all the exercises without any complain. Pain of right knee joint was present at increased active and active ROM with assistance, His performance of exercises was better than previous sessions.

Self-therapy:

- Deep vein thrombosis prevention 5 min. every hour
- Pillow or soft ball under knee in bed for isometric contraction of quadriceps 10-12 repetitions, 3 times a day.
- Flexing the knee by sliding the heel on bed towards the buttocks for isotonic contraction of tibialis anterior and hamstrings 10-12 repetitions, 3 times a day.

3.5.4 4th day 11.2.2019

Objective:

Before today's session start the patient informed that he felt pain during the night at the right knee pain scale 3/10, he had less energy to perform the exercises than before the weekend.

Subjective:

Today's therapy started by Patient knee flexion of 80 ° of passively, and 70 ° actively. With the starting position of 5 ° into extension. passive S:0-5-80, active S:0-5-70. Also patient scare is covered by bandages after the removal of the stitches.

Goals of today's therapeutic unit:

- Reduce pain and edema with active movements in hip, knee and ankle joints.
- Prevent thromboembolism (muscle pump exercises).
- Release tension from soft tissues with soft tissue techniques, by Lewit in right thigh, calf and increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps, adductors, abductors and increase ROM in hip joint (F, E), in knee joint F and in ankle joint PF and DF, with active movements.
- Release restriction from blocked joints
- Scare care.

Results:

Objective:

His performance of exercises was motivated and giving full effort although he is not feeling well today.

Self-therapy:

- Deep vein thrombosis prevention 5 min. every hour
- Pillow or soft ball under knee in bed for isometric contraction of quadriceps 10-12 repetitions, 3 times a day.
- Flexing the knee by sliding the heel on bed towards the buttocks for isotonic contraction of tibialis anterior and hamstrings 10-12 repetitions, 3 times a day.

3.5.5 5th Day 12.2.2019

Objective:

The patient got used to the rehabilitation plan and have been motivated and cooperative.

Subjective:

Today's therapy started by Patient knee flexion of 90 ° of passively, and 70 ° actively. With the starting position of 5 ° into extension. passive S:0-5-90, active S:0-5-70. Also patient scare is covered by bandages after the removal of the stitches.

Goals of today's therapeutic unit:

- Reduce pain and edema.
- Prevent thromboembolism (muscle pump exercises).
- Scare care.
- Release tension from soft tissues with soft tissue techniques, (by Lewit) in right thigh, calf and increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps, adductors, abductors and increase ROM in hip joint (F, E), in knee joint F and in ankle joint PF and DF, with active movements.
- Joint play techniques (by Lewit) to Unblock the restricted joints of Interphalangeal joints of toes, in all the directions (both), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Correct breathing stereotype, increase lung capacity and expansion of thorax.

Procedures:

- Scar therapy has been done by the mobilization of the scar tissue and applying STT around the scar.
- Exercises in supine and seating position: dorsal flexion and plantar flexion of the ankle joints and circumduction repeat and change to opposite circumduction. Duration of 5 minutes, repetitions each hour. Isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.
- Supine on bed Active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times.
Also adduction and abduction movements of hip joint. Repeat 7 times. Also active movements and with resistance dorsal flexion and planter flexion of the ankle. Repeat 7 times.
- Joint play techniques (by Lewit) for: interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints in all the directions (both sides), dorsal and plantar fan (both sides). right patella caudally, fibular head both direction (both sides), chopart joint caudally (left sides), Interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Treatment of trigger point on the right adductor region.
- Application of device CPM for the 30 minutes with settings on F:90 degrees and E:5 degrees.

Results:

Patient feedback today that he is feeling better, had the energy to perform all the exercises today's session started with the. Less Pain of right knee joint was present at increased active and active ROM with assistance, His performance of exercises was motivated and giving full effort.

3.5.6 6th day 13.2.2019

objective:

The patient came motivated, as he is saying he is feeling better and had no complication through the night.

Subjective:

Today's therapy started by Patient knee flexion of 90 ° of passively, and 80 ° actively. With the starting position of 5 ° into extension. passive S:0-5-90, active S:0-5-80. Also patient scare is not covered by bandages anymore.

Goals of today's therapeutic unit:

- Reduce pain and edema with active movements in hip, knee and ankle joints.
- Prevent thromboembolism (muscle pump exercises).
- Release tension from soft tissues with soft tissue techniques, by Lewit in to increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps, adductors, abductors and increase ROM in hip joint (F, E), in knee joint F and in ankle joint PF and DF, with active movements.
- Unblock restricted joints with Joint play techniques (by Lewit) for Interphalangeal joints of toes, in all the directions (both), Metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Correct breathing stereotype, increase lung capacity and expansion of thorax.

Procedures:

- Scar therapy has been done by the mobilization of the scar tissue carefully as it's still with stiches and also mobilization of the soft tissue surrounds the scar.
- Exercises in supine and seating position: dorsal flexion and plantar flexion of the ankle joints and circumduction Repeat and change to opposite circumduction. Duration of 5 minutes, repetitions each hour. Isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.
- Supine on bed Active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times. Also adduction and abduction movements of hip joint. Repeat 7 times. Also active movements and with resistance dorsal flexion and planter flexion of the ankle. Repeat 7 times.
- Stretching PIR (by Lewit) for the right adductors m., hamstrings m., Rectus Femoris M., and tensor fasciae latae 3 times for each.
- Joint play techniques (by Lewit) for: Interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints in all the directions (both sides), dorsal and plantar fan (both sides). right patella caudally, fibular head both direction (both sides), chopart joint caudally (left sides), Interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Control of transitioning positions (from supine to prone, to side and from bed to standing).
- Passive Stretching for right adductors m. and right Rectus Femoris m.
- Treatment of trigger point if present today.
- Isometric exercises with use of soft ball for both quadriceps m.

- Mobilization of the right head of Fibula and right cuboid.
- Application of device CPM for the 30 minutes with settings on F:90 degrees and E:5 degrees.

Results:

Objective:

Today's session the patient came in a good mood after good news from the doctor of his results and ability to leave home in 2 days. He had the energy to perform all the exercises. Pain of right knee joint was present at the end of the session after exercises. His performance of exercises was motivated as previous days.

Self-therapy:

- Deep vein thrombosis prevention 5 min. every hour
- Pillow or soft ball under knee in bed for isometric contraction of quadriceps 10-12 repetitions, 3 times a day.
- Flexing the knee by sliding the heel on bed towards the buttocks for isotonic contraction of tibialis anterior and hamstrings 10-12 repetitions, 3 times a day.

3.5.7 7th day 14.2.2019

objective:

The patient mood improved since pain is less in the last nights, and therapy started with no complications.

Subjective:

Today's therapy started by patient knee flexion over 90 ° of passively, and 80 ° actively. With the starting position of 5 ° into extension. passive S:0-5-90, active S:0-5-80.

Goals of today's therapeutic unit:

- Reduce post-operative pain and edema with active movements in hip, knee and ankle joints.
- Prevent thromboembolism (muscle pump exercises).
- Train transitioning positions and verticalisation.
- Release tension from soft tissues with soft tissue techniques, by Lewit in right thigh, calf and increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps, adductors, abductors and increase ROM in hip joint (F, E), in knee joint F and in ankle joint PF and DF, with active movements.
- Unblock restricted joints with Joint play techniques by Lewit for: Interphalangeal joints of toes, in all the directions (both), Metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).

Procedures:

- Soft tissue techniques (by Lewit) applied on right thigh using hand and soft ball, right thigh, knee region and calf in all directions.
- Scar therapy has been done by the mobilization of the scar tissue carefully as it's still with stiches and also mobilization of the soft tissue surrounds the scar.
- Exercises in supine and seating position: dorsal flexion and plantar flexion of the ankle joints and circumduction Repeat and change to opposite circumduction.

Duration of 5 minutes, repetitions each hour. Isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.

- Supine on bed Active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times.
Also adduction and abduction movements of hip joint. Repeat 7 times. Also active movements and with resistance Dorsal Flexion and Planter Flexion of the ankle. Repeat 7 times.
- Stretching PIR (by Lewit) for the right adductors m., hamstrings m., Rectus Femoris M., and tensor fasciae latae 3 times for each.
- Joint play techniques (by Lewit) for: right patella caudally, fibular head both direction (both sides), chopart joint caudally (left sides)
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Passive Stretching for right adductors m. and right Rectus Femoris m.
- Treatment of trigger point on the right adductor region.
- Isometric exercises with use of soft ball for the right quadriceps m.
- Application of device CPM for the 30 minutes with settings on F:100 degrees and E:5 degrees.

Results:

Today's session showed result made the patient feel better about his case. The patient kept the high effort and the motivation during the session. Also there was an improvement of knee flexion over passively almost to 100°, and more than 80 ° actively. With the starting position of 5 ° into extension.

Self-therapy:

- Self-care and PIR for gastrocnemius M.

3.5.8 8th day 15.2.2019

Goals of today's therapeutic unit:

- Reduce post-operative pain and edema with active movements in hip, knee and ankle joints.
- Release tension from soft tissues with soft tissue techniques, by Lewit in right thigh, calf and increase elasticity and extensibility.
- Increase strength in weakened muscles quadriceps, adductors, abductors and increase ROM in hip joint (F, E), in knee joint F and in ankle joint PF and DF, with active movements.
- Unblock restricted joints with joint play techniques by Lewit for: interphalangeal joints of toes, in all the directions (both), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Make sure the patient is aware of the contraindications, self-therapy and the use of crutches in correct way.

Procedures:

- Soft tissue techniques (by Lewit) applied on right thigh using hand and soft ball, right thigh, knee region and calf in all directions.
- Scar therapy has been done by the mobilization of the scar tissue carefully, also mobilization of the soft tissue surrounds the scar.
- Exercises in supine and seating position: dorsal flexion and plantar flexion of the ankle joints and circumduction Repeat and change to opposite circumduction. Duration of 5 minutes, repetitions each hour. Isometric contraction of quadriceps while dorsal flexing ankle and extending knee joint. Repeat 10 times.
- Supine on bed Active movements exercises to increase the active range of motion for the knee and hip joint, also to improve the muscle strength of quadriceps m., adductors m., abductors m. and calf muscles of both sides. Flexion of hip joint along with flexion of knee joint. Actively and passively repeated 7 times. Also adduction and abduction movements of hip joint. Repeat 7 times. Also active

movements and with resistance Dorsal Flexion and Planter Flexion of the ankle.
Repeat 7 times.

- Stretching PIR (by Lewit) for the right adductors m., hamstrings m., Rectus Femoris M., and tensor fasciae latae 3 times for each.
- Joint play techniques (by Lewit) for: Interphalangeal joints of toes, in all the directions (both sides), Metatarsophalangeal joints in all the directions (both sides), dorsal and plantar fan (both sides). right patella caudally, fibular head both direction (both sides), chopart joint caudally (left sides), interphalangeal joints of toes, in all the directions (both sides), metatarsophalangeal joints (both), dorsal & plantar fan as well (both sides).
- Gait exercises to by walking up and down stairs, walking along the corridor.
- Passive Stretching for right adductors m. and right Rectus Femoris m.
- Treatment of trigger point on the right adductor region.
- Isometric exercises with use of soft ball for the right quadriceps m.
- Mobilization of the right head of Fibula and right cuboid.
- Application of device CPM for the 30 minutes with settings on F:110 degrees and E:5 degrees.

Results:

As the patient got used to the treatment program, treatment was applied with no complication with the cooperation of the patient. There wasn't a remarkable change to yesterday's session. But the operated knee passive ROM have slightly increase into flexion to almost 110 degrees. Also pain scale dropped to 2/10.

2.7. Final Kinesiological examination

3.5.9 Final Postural Examination according to Kendall

Posterior view (With crutches. Without plumb line)

The base of support:	Narrow base support also shows signs of hip joint external rotation
Shape and position of the ankle joints:	Symmetrical in shape and position
Shape and thickness of the Achilles tendons:	Achilles tendon is slightly valgus on both side
Contour of the calf muscles:	The right calf has less edema and lower signs of Hypertrophy
Shape and position of the knee joints:	The right knee is less swollen
Popliteal line:	popliteal lines are in external rotation on both side
Gluteal muscles:	Symmetrical in shape and position
Symmetry of the thoracobrachial triangles:	Symmetrical
Position of the pelvis:	Symmetrical slight external rotation of the hip joint.
Paravertebral muscles:	No abnormality
Curvature of the spine in the frontal plane	There is no visible curve
Position of the scapula:	Right scapula is abducted
Weight distribution:	Weight is loaded more on the left side
Position of the shoulder girdle:	The right side is higher
Position of the upper limb:	Symmetrical , in a slight abduction
Position of the head:	The back is slightly bended forward at the level of the Th

Table 14 Final postural examination Posterior view

Anterior view

The base of support	Narrow base support also shows signs of hip joint external rotation
The position of the feet	The right foot (operated side) doesn't have a full contact with the floor. As the left one
The position and the shape of toes	Symmetrical in position and shape
Weight disruptions	Weight is loaded more on the left side
Shape and position of the knee joints	The right knee is less swollen also Slight external rotation of both patella joints
Configuration of the tibialis anterior muscle	Slightly Asymmetrical due to swelling of the operated side
Contour of the anterior compartment muscles of the lower leg	Right side is more visible since swelling of the right side is reduced
Position of the pelvis	Symmetrical
Muscle tone symmetry of the abdominal muscles	Although its Slightly visible , its Symmetrical
Position of the umbilicus	Umbilicus slightly shifted to the right
Symmetry of the thoracobrachial triangles	Symmetrical
Position and symmetry of the chest	Symmetrical with no deformities
Position of the sternum	Optimal with no sign of rotation
Position of the shoulder girdle	The right side is higher in postion
Position of the upper limbs	Symmetrical Shoulders are slightly abducted
Position of the head	Optimal, No sign of rotation

Table 15 Final postural examination Posterior view

Lateral view

Weight distribution	More load is on the lateral aspect of the foot on non-operated side with crutches.
Shape and position of the ankle joints	Planter flexion of the right side while left is slightly pronated
Shape and contour of the shin	Symmetrical
Position of the knee joints	Left is in hyperextension , Right is in semi flexion
Contour of the thigh muscles	Its clearer at the left thigh than the right.
Position of the pelvis	Slightly tilted forwarded
Position and curvature of the spine	Physiological curve of all components
Shape of the abdominal muscles	Not bulging out , not frame
Position of the shoulder girdles	Protraction of the shoulders on both sides
Position of the head	Slight Protraction of the head

Table 16 Final postural examination Posterior view

3.5.10 Anthropometrical measurement

	Sin.	dx.
Thigh	51 cm	49 cm
10cm above the patella	46.5cm	43cm
Over the patella	38cm	41cm
Around the patella	39cm	40cm
under the patella	34cm	33cm
Calf	35,5cm	34cm
Ankle	23.5cm	23cm
Around meta tarsals	76.2 cm	76 cm
Anatomical length	85.5 cm	85.5 cm

Table 17 Final Anthropometrical measurements

3.5.11 Aspection

He has a 16 cm long scar on the right knee. There is less edema/swelling in his right knee and his leg just around the right knee caudally than first day.

There was no sign of hematomas

Right knee is in semi flexion, restricted to extension.

3.5.12 Palpation

(According to Janda)

Muscle	Sin.	Dx.
Semitendinosus	Normal tone	Hypertonic
Semimembranosus	Normal tone	hypertonic
Rectus femoris	Normal tone	Normal tone
Vastus medialis	Normal tone	hypotonic
Vastus lateralis	Normal tone	hypotonic
Vastus intermedius	Normal tone	hypotonic
Biceps femoris	Normal tone	Normal tone
Abductors of hip	Normal tone	Normal tone
Piriformis	Normal tone	Normal tone
Quadratus lumborum	Normal tone	Normal tone

Table 18 Final Palpation

Skin:

The restricted skin of the anterior part of the right knee have got more motion and move with slight restriction compering to first day. also the increase of temperature in the right knee still more than the left one. Skin of the anterior part of the calf is has less restriction than first day.

Subskin and fascia:

Generally, there wasn't any restriction on the left side. And it has improved at the right upper and lower leg.

3.5.13 Length test (According to Janda)

Muscle	Sin.	dx.
Hip flexors one-joint muscles	0	0
Hip flexors two-joint muscles	0	0
Adductors one joint	0	0
Adductors two-joint	0	0
hamstring	0	1
Gastrocnemius	0	n/a

Table 19 Final Length test

3.5.14 Range of motion Examination SFTR

Active ROM

Hip Joint		
Plane	Sinister	Dexter
S	10°-0°-110°	10°-0°-100°
F	45°-0°-15°	45°-0°-15°
R	50°-0°-15°	40°-0°-15°

Knee Joint		
Plane	Sinister	Dexter
S	0°-0°-130°	0°-5°-80°

Ankle Joint		
Plane	Sinister	Dexter
S	40°-0°-10°	45°-0°-10°
R	20°-0°-30°	20°-0°-30°

Table 20 Final Active Range of motion

Passive ROM

Hip Joint		
Plane	Sinister	Dexter
S	15°-0°-115°	15°-0°-105°

F	45°-0°-20°	35 °-0 °-20°
R	50°-0°-25°	35 °-0 °-20 °

Knee Joint		
Plane	Sinister	Dexter
S	0 °-0 °-130°	0 °-5 °-100 °

Ankle Joint		
Plane	Sinister	Dexter
S	40 °-0 °-10 °	45 °-0 °-10 °
R	20 °-0 °-30 °	20 °-0 °-30 °

Table 21 Final Passive motion

3.5.15 Pelvic Examination

The Iliac crest	Right is slightly higher
ASIS	Right is slightly higher
PSIS	Right is slightly higher

Table 22 Final Pelvic examination

3.5.16 Final Gait Examination

Width of the base of support	Increased since first day
Walking rhythm	Increased the speed since first day
Stride length	Right foot is shorter
Movement of the foot	
<ul style="list-style-type: none"> • Heel strike 	Optimal on left absent on the right
<ul style="list-style-type: none"> • Flat foot 	Presented on both
<ul style="list-style-type: none"> • Loading response 	Slightly increased on the right side comparing to first day
<ul style="list-style-type: none"> • Heel off 	Optimal on left while on the right it
<ul style="list-style-type: none"> • Toe off 	takes off together.
Movement and position of the knee and hip	On left is optimal , on right movement of the knee is absent
Position and movement of the pelvis	Slight tilted pelvis with no sign of drop
Movement of centre of gravity	Patient is stable most of his gait
Position and movements of the trunk	Changed to upright position during the movement
Position of the spine	No sign of rotation
Activity of the back muscles	Normal activity
Activity of the abdominal muscles:	Normal activity
Position of the shoulders	Slightly protracted
Position and movements of the head	Slightly protracted
Movements of the upper extremity	Movement is presented using the crutches
Stability of walking	The stability improved since first day

3.5.17 Final Strength test:

(According to Kendall)

Muscle	Sin	dx
Quadriceps femoris	5	4 with limited ROM
Iliopsoas	5	5
Hamstring	5	4
Gluteus maximus	4	4
Hip Adductors	4	4
Hip Abductors	5	4
Tibialis anterior	5	4
Triceps surae	5	5

Table 23 Final Pelvic examination

3.5.18 Final Movement stereotypes (According to Janda)

Hip extension:

Movement pattern on right hip:

- Gluteus maximus (ipsilateral)
- Hamstrings (ipsilateral)
- Spinal extensors lumbar(contralateral)
- Spinal extensors lumbar(ipsilateral)
- Spinal extensors thoracic(contralateral)
- Spinal extensors thoracic (ipsilateral)
- Shoulder girdle (ipsilateral)

Movement pattern on left hip:

- Hamstrings (ipsilateral)
- Spinal extensors lumbar (contralateral)
- Spinal extensors lumbar (ipsilateral)
- Gluteus maximus (ipsilateral)
- Spinal extensors thoracic (contralateral)
- Spinal extensors thoracic (ipsilateral)
- Shoulder girdle (ipsilateral)

Hip abduction:

Altered pattern on both legs: patient does have clean abduction with no rotation or flexion.

3.5.19 Neurological examination:

Higher function: physiological

Position sense: physiological

Sensations of dermatomes in lower extremity with light touch: physiological

Deep tendon reflexes: physiological

Examination of pain: Less pain on the right knee region of L4, S1, S2 dermatomes compering at first day.

3.5.20 Joint play examination (According Lewit):

Joint	Sin	Dx
Patella	No restriction	No restriction
Fibular head	No restriction	stiff in all direction
Talocal	No restriction	No restriction
Subtalar	No restriction	No restriction
Chopart	No restriction	No restriction
Lisfrance	No restriction	No restriction

Table 24 Final Pelvic examination

MTP: stiffness at the left foot is not present anymore.

PIP: No restrictions or stiffness.

DIP: no sign of stiffness

The right fibular head was blocked in all direction at the first examination, but not anymore. Slightly stiff metatarsals and distal interphalangeal (DIP) joints of both feet but not blocked.

3.5.21 Conclusion of final examination

The final examination concludes several changes starting from postural examination which shows a slight improvement can be found at the base of support and improvement of standing using the crutches. There was also an improvement of the gait when it comes to speed and length of the steps, better up right position and better use of crutches.

At The final active and passive ROM examination an improvement could be found specially at the knee joint. Although at the final examination the results were not sufficient, the patient had a better ROM the day before and earlier of the final examination day. Which I believe it have been effected by the exercise at the morning of the final examination day. We haven't reached the goal of the therapy but yet we are close to achieve it.

The rest of the examinations also had an improvement like strengthening the weak muscles, restoration of joint play, balancing of muscle tone. The more details could be found in the section 3.6 effect of therapy.

3.6 Effect of the therapy

3.6.1 Pain level comparison

First day	6/10
Final day	2/10

Table 25 Pain level comparison

The patient pain level has been decreased comparing the first day, patient have been cooperative during the therapy and learned self-therapy to help him make the experience of pain decreases.

3.6.2 Postural examinations comparison

At the postural examinations there we found an improvement of the base of support width, and standing alignment as the patient have got used to the use of crutches.

There were no significant changes at the postural examinations in general apart of correcting the standing position and the reduce of atrophy of right thigh and knee. The external rotation of the lower extremities is still present with the slight anterior tilt of the pelvis.

3.6.3 Anthropometric measurements comparison

The effect of the therapy can be found only at the level of the thigh and 10cm above the patella as the following table shows.

Part	Sin.	dx.
Thigh	Initial: 51 cm	Initial: 44 cm
	Final: 51cm	Final: 49cm
10cm above the patella	Initial: 46.5cm	Initial: 42cm
	Final: 46.5cm	Final: 43cm

Table 26 Anthropometric measurements comparsion

3.6.4 Gait examination effect

At the gait examination there have been an improvement of the gait speed, stability and the motion at the knee joint.

Initial	Final
Slow gait	The speed of gate increased
Inability to extend the right knee	Ability to extend the right knee
Unstable gait	Stable gait

Table 27 changes in gait

3.6.5 ROM comparison

Patient had an improvement when it comes to ROM in both active and passive. Although in the last session after applying therapy to the operated knee, the passive ROM have slightly increase into flexion to 0 -0 -110 degrees which also had a 0 extension, it wasn't the same during the final examination it dropped by 10 degrees.

Initial Active ROM of the knee joint		
Plane	Sinister	Dexter
S	0 °-0 °-130°	0 °-5 °-70 °
Final Active ROM of the knee joint		
Plane	Sinister	Dexter
S	0 °-0 °-130°	0 °-5 °-80 °

Table 28 Active ROM of the knee joint comparison

Initial passive ROM of the knee joint		
Plane	Sinister	Dexter
S	0 °-0 °-130°	0 °-5 °-80 °
Final passive ROM of the knee joint		
Plane	Sinister	Dexter
S	0 °-0 °-130°	0 °-5 °-100 °

Table 29 Passive ROM of the knee joint comparison

3.6.6 Strength comparison

When we compare the results of muscle strength tests, the therapy effect helped improving the strength of the following muscles at the table. But the patient condition is still in need of improvement further till the muscle strength is symmetrical on both sides and is back within its physiological level.

Muscle		Sin	dx
Quadriceps femoris	Initial	5	3 with limited ROM
	Final	5	4 with limited ROM
Iliopsoas	Initial	5	5
	Final	5	4
Hamstring	Initial	5	3
	Final	5	4
Gluteus maximus	Initial	4	3
	Final	4	4
Hip Adductors	Initial	4	4
	Final	4	4
Hip Abductors	Initial	5	3
	Final	5	4
Tibialis anterior	Initial	5	4
	Final	5	4
Triceps surae	Initial	5	5
	Final	5	5

Table 30 Strength comparison

3.6.7 Joint play comparison

The joint play therapy did effect the patient positively, it restored the motion in the right patella, left chopart and left fibular head and improved the right fibular head from blocked to stiff motion.

Joint		Sin	Dx
Patella	Initial	No restriction	Restricted caudally
	Final	No restriction	No restriction
Fibular head	Initial	Stiff caudally	Blocked in all direction
	Final	No restriction	stiff in all direction
Talocural	Initial	No restriction	No restriction
	Final	No restriction	No restriction
Subtalar	Initial	No restriction	No restriction
	Final	No restriction	No restriction
Chopart	Initial	Stiff/restricted	No restriction
	Final	No restriction	No restriction
Lisfrance	Initial	No restriction	No restriction
	Final	No restriction	No restriction

Table 31 Joint play comparison

3.6.8 Palpation comparison

The Table below shows the effect of therapy during the palpation, mostly the effect can be found at the upper part of the operated leg muscles. Although the therapy was provided to help decrease more parts, the duration of the therapy plan didn't help enough to improve muscle tone.

Muscle		Sin.	Dx.
Semitendinosus	Initial	Hypertonic	hypertonic
	Final	hypertonic	Hypertonic
Semimembranosus	Initial	hypertonic	hypertonic
	Final	hypertonic	hypertonic
Rectus femoris	Initial	hypertonic	hypotonic
	Final	Normal tone	Normal tone
Vastus medialis	Initial	hypotonic	hypotonic
	Final	Normal tone	hypotonic
Vastus lateralis	Initial	Normal tone	Hypotonic
	Final	Normal tone	hypotonic
Vastus intermedius	Initial	Normal tone	Hypotonic
	Final	Normal tone	hypotonic
Biceps femoris	Initial	Normal tone	hypertonic
	Final	Normal tone	Normal tone
Abductors of hip	Initial	Normal tone	hypertonic
	Final	Normal tone	Normal tone
Piriformis	Initial	Normal tone	Normal tone
	Final	Normal tone	Normal tone
Quadratus lumborum	Initial	Normal tone	Normal tone
	Final	Normal tone	Normal tone

3.7 Conclusion

The patient has been doing all the effort he could to improve his health condition. During the 2 weeks' therapy he was able to help achieving the goals of the therapy. The patient range of motion hadn't reach the goal of the therapy plan at the extension it reached 0 degree at rest in the 5th day but was 5 at the final examination. But the Muscle strength was positively improving Since the first day, the patient muscle power was at higher level than the patient with similar case at the department, with the high motivation and great cooperation from the patient during the therapy and exercise program. Also we made sure the patient is aware of the correct gait and posture while using the crutches

The patient's Prognosis is excellent. He is able to keep improving his present level of health statue by following the self-therapy plan, and also follow the check-up visits with the doctor. working on his daily exercises.

The Progress of Patient was improving when it comes to the range of motion of the operated knee, a 20 degrees increase of flexion in both active and passive motion after the 8 therapy sessions he had. While extension has improved at the 5th session and reached 0 degrees but return to a 5 degrees starting position at the final examinations. The right lower extremities Muscle condition has been also improving since first day, patient had low activity of right vastus lateralise m. at the first sessions for example and already improved by finishing the 3rd session. Although he was feeling tired at the first sessions, his motivation to improve his statue was always helping us to do what therapy indicates. Also his ability to stand and change position is more fluent then the first day, Patient muscle tone have increased at the operated side at Quadriceps femoris m., also during the therapy session we have been preventing an increase of tone of hamstrings and the adductors of hip joint of both sides and left quadriceps femoris M. by using soft tissue techniques and the PIR (by Lewit).

The main goals of physiotherapeutic plan mostly after a total knee replacement is helping to get pain relieved, restore the strength of muscles around the operated knee joint, prevent the changes musculoskeletal, improve range of motion, provide scar care, improve gait and help the patient to be back to the activities of daily living. Patients are not the same each patient have a specific requirement that the patient needs to be fully

treated well depending on many factors that should be considered before making a therapy or a rehabilitation plan as every patient requires an individual therapeutic approach.

Luckily in this study the patient didn't require much specification to be considered apart from the common therapy approaches such as the exercises created for the patient to provide a positive effect on the global stability of the patient to help improving and restoration of gait. The short term therapy goals mostly were achieved at the end of the study. Finally, I believe that the two weeks I have spent at the rehabilitation department in Kladno's Hospital were a great experience which I learned a lot from my supervisor and the physiotherapists at the department while dealing with my patients and many other patients with their diverse cases.

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5 Supplements

5.1 Figures

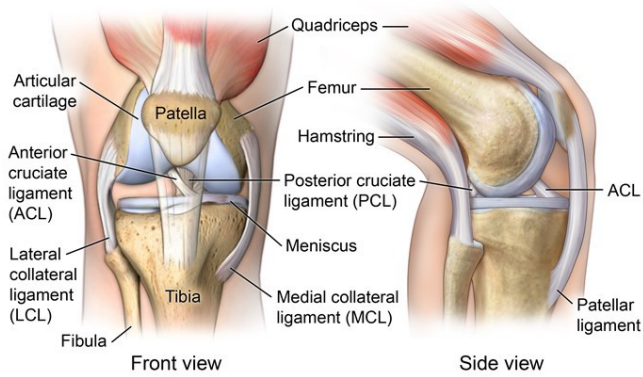


Figure 8 Bones of the Knee (1)

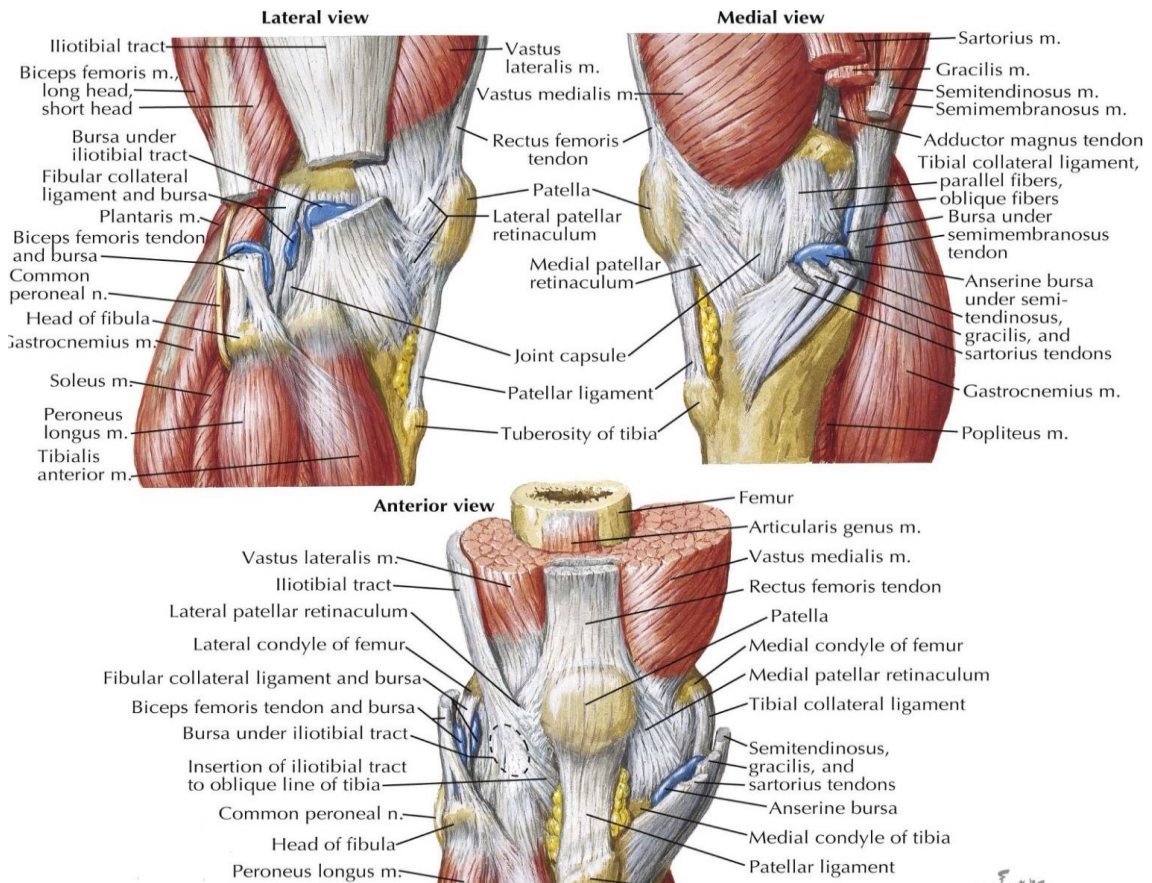


Figure 7 The Anatomy of the knee joint (2)

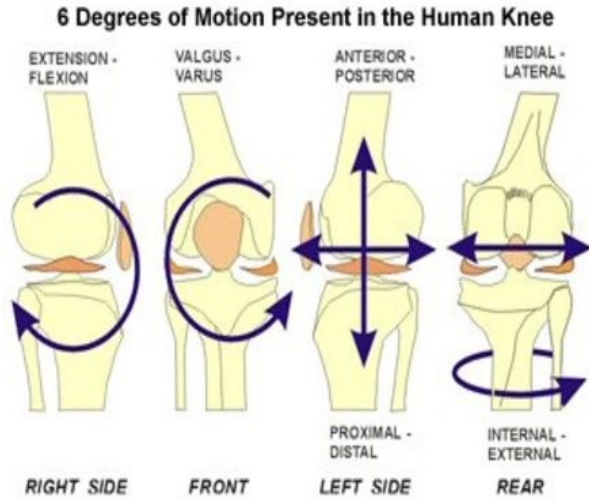


Figure 10 Degrees of motion in the knee joint(19)

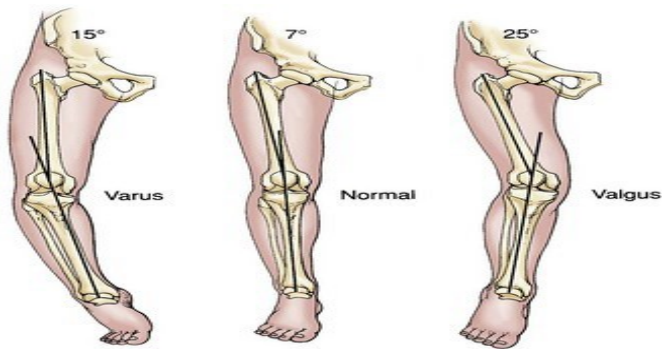


Figure 12 Degrees of motion in the knee joint (26)



Figure 11 Grades of osteoarthritis of knee joint shown in an X-ray(3)

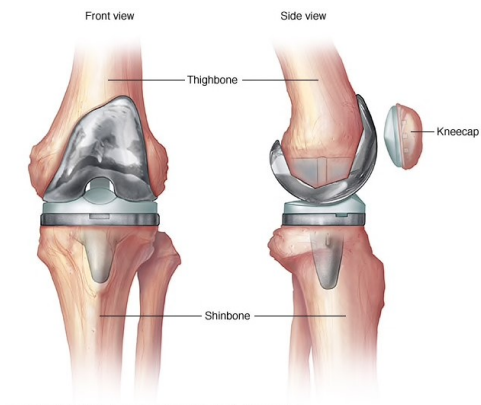


Figure 9 Artificial knee joints (30)

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5.4 Application for Approval by UK FTVS Ethics committee

CHARLES UNIVERSITY
FACULTY OF PHYSICAL EDUCATION AND SPORT
José Martího 31, 162 52 Prague 6-Vešelavín

Application for Approval by UK FTVS Ethics Committee

of a research project, thesis, dissertation or seminar work involving human subjects

The title of a project: Case Study of Physiotherapy Treatment of arthrosis patient after total knee replacement

Project form: Bachelor thesis

Period of realization of the project: March 2019

Applicant (Main researcher): Naif Aouda A Alyoubi, UK FTVS-Physiotherapy department

Workplace: Oblastní Nemocnice Kladno

Supervisor: PhDr. Jitka Malá, Ph.D.

Project description: a case study of arthrosis patient after total knee replacement conducted under the expert supervision of experienced physiotherapists at Oblastní Nemocnice Kladno.

Characteristics of participants in the research: 1 male patient aged 50, staying for 2 weeks at Oblastní Nemocnice Kladno

Ensuring safety within the research: A physiotherapist employed by the Institute of Oblastní Nemocnice Kladno will be present during the examination and therapy session to ensure the quality and safety of the procedures performed. He should be professionally competent to practice physiotherapy according to the Czech regulations. No invasive procedures will be performed. Risks of therapy and methods will not be higher than the commonly anticipated risks for this type of therapy.

Ethical aspects of the research: The participating patient will be a male adult who is not suffering from any mental conditions. This study may help to better understand the condition suffered by the patient and to identify the procedures which may be beneficial for the condition.

Personal data protection the gained data will be processed and safely retained in an anonymised form and published in a bachelor thesis, possibly also in journals, monographs, and presented at conferences, possibly also used in further research at UK FTVS. After the anonymization the personal data will be deleted.

I shall ensure to the maximum extent possible that the research data will not be misused.

Informed Consent: attached

It is the duty of all participants of the research team to protect life, health, dignity, integrity, the right to self-determination, privacy and protection of the personal data of all research subjects, and to undertake all possible precautions. Responsibility for the protection of all research subjects lies on the researcher(s) and not on the research subjects themselves, even if they gave their consent to participation in the research. All participants of the research team must take into consideration ethical, legal and regulative norms and standards of research involving human subjects applicable not only in the Czech Republic but also internationally.

I confirm that this project description corresponds to the plan of the project and, in case of any change, especially of the methods used in the project, I will inform the UK FTVS Ethics Committee, which may require a re-submission of the application form.

In Prague, 11.3.2019

Applicant's signature: نايف اليعوبي

Approval of UK FTVS Ethics Committee

The Committee: Chair: doc. PhDr. Irena Parry Martínková, Ph.D.

Members: prof. PhDr. Pavel Slepíčka, DrSc.
doc. MUDr. Jan Heller, CSc.
PhDr. Pavel Hráský, Ph.D.
Mgr. Eva Prokešová, Ph.D.
MUDr. Simona Majorová

The research project was approved by UK FTVS Ethics Committee under the registration number: 099/2019

Date of approval: 11.3.2019

UK FTVS Ethics Committee reviewed the submitted research project and found no contradictions with valid principles, regulations and international guidelines for carrying out research involving human subjects.

The applicant has met the necessary requirements for receiving approval of UK FTVS Ethics Committee.

UK FTVS
Fakulta tělesné výchovy a sportu
José Martího 31, 162 52, Praha 6
Stamp of UK FTVS

Signature of the Chair of
UK FTVS Ethics Committee

5.5 Patient Consent Form

UNIVERZITA KARLOVA
FAKULTA TĚLESNÉ VÝCHOVY A SPORTU
Josef Martího 31, 162 52 Praha 6-Veleslavín

INFORMOVANÝ SOUHLAS

Vážená paní, vážený pane,

v souladu se Všeobecnou deklarací lidských práv, zákonem č. 101/2000 Sb., o ochraně osobních údajů a o změně některých zákonů, ve znění pozdějších předpisů, Helsinskou deklarací, přijatou 18. Světovým zdravotnickým shromážděním v roce 1964 ve znění pozdějších změn (Fortaleza, Brazílie, 2013) a dalšími obecně závaznými právními předpisy Vás žádám o souhlas s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie prováděné v rámci praxe na Oblastní nemocnici Kladno, kde Vás příslušně kvalifikovaná osoba seznámila s Vaším vyšetřením a následnou terapií. Výsledky Vašeho vyšetření a průběh Vaší terapie bude publikován v rámci bakalářské práce na UK FTVS, s názvem

Získané údaje, fotodokumentace, průběh a výsledky terapie budou uveřejněny v bakalářské práci v anonymizované podobě. Osobní data nebudou uvedena a budou uchována v anonymní podobě. V maximální možné míře zabezpečím, aby získaná data nebyla zneužita.

Jméno a příjmení řešitele Podpis:.....

Jméno a příjmení osoby, která provedla poučení..... Podpis:.....

Prohlašuji a svým níže uvedeným vlastnoručním podpisem potvrzuji, že dobrovolně souhlasím s prezentováním a uveřejněním výsledků vyšetření a průběhu terapie ve výše uvedené bakalářské práci, a že mi osoba, která provedla poučení, osobně vše podrobně vysvětlila, a že jsem měl(a) možnost si řádně a v dostatečném čase zvážit všechny relevantní informace, zeptat se na vše podstatné a že jsem dostal(a) jasné a srozumitelné odpovědi na své dotazy. Byl(a) jsem poučen(a) o právu odmítnout prezentování a uveřejnění výsledků vyšetření a průběhu terapie v bakalářské práci nebo svůj souhlas kdykoli odvolat bez represí, a to písemně zasláním Etické komisi UK FTVS, která bude následně informovat řešitele.

Místo, datum

Jméno a příjmení pacienta Podpis pacienta:

Jméno a příjmení zákonného zástupce

Vztah zákonného zástupce k pacientovi Podpis:

5.6 List of Abbreviations.

OA – Osteoarthritis
ROM - Range of Motion
SFTR - Sagittal-Frontal-Transverse-Rotation
ACL - Anterior Cruciate Ligament
PCL - Posterior Cruciate Ligament
ASIS - Anterior Superior Iliac Spine
PSIS - Posterior Superior Iliac Spine
FLEX – Flexion
EXT – Extension
ABD – Abduction
ADD – Adduction
ER - External Rotation
IR - Internal Rotation
DORSI - Dorsiflexion
PLANT – Plantarflexion
ADL – Activity of Day Living
UE - Upper Extremities
LE - Lower Extremities
MTP – Metatarsophalangeal
DIP - Distal Interphalangeal
PIP - Proximal Interphalangeal
DTR - Deep Tendon Reflexes
PIR - Post Isometric Relaxation
TFL - Tensor Fascia Latae
BMI - Body Mass Index
CT - Computer Tomography
STT - Soft Tissue Techniques
NSAIDs - Nonsteroidal Anti-Inflammatory Drugs
SYSADOA - Symptomatic Slow-Acting Drugs