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Department of physiotherapy

Case Study Patient with Diagnosis After Total Knee Replacement on Left Side

BACHELOR DEGREE PROGRAM IN PHYSIOTHERAPY

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ABSTRACT

Title of the thesis: Case study of patient after Total Knee Replacement on left side

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Work placement: Centrum léčby pohybového aparátu Mediterra

Summary

In the bachelor thesis, which was written by myself, it is divided in two parts, theoretical part and case study.

The theoretical part explains anatomy of Knee joint, it's bones, muscles, ligaments, nerves and blood supply and surgical and non-surgical approaches of therapy of the knee joint and Rehabilitation after surgery. Information about biomechanical and kinesiological point of view were discussed as well.

In the practical part I analyzed procedures I have done with the patient, all examinations, conclusions, therapies and results.

Last part of the bachelor thesis it contains list of literature that used in the bachelor thesis, it contains list of tables and figures used in the thesis, abbreviations and the ethics committee.

Keywords: Knee joint, knee arthoplasty, total knee replacement, patella, knee exercises.

ABSTRAKT

Název práce: Případová studie pacienta po celkové náhradě kolenního kloubu na levé straně

Autor: Mohammed Abdullah Al Qarni

Stáž: Centrum léčby pohybového aparátu Mediterra

Shrnutí

Bakalářská práce, kterou jsem napsal sám, je rozdělena do dvou částí, teoretické části a případové studie.

Teoretická část vysvětluje anatomii kolenního kloubu, kolenních kostí, svalů, vazů, nervů a krevní zásobení, a dále chirurgické a nechirurgické přístupy léčby kolenního kloubu a rehabilitaci po operaci. Dále jsou zde diskutované Informace z biomechanického a kineziologického hlediska.

V praktické části jsem analyzoval postupy, které jsem provedl s pacientem, všechna vyšetření, závěry, léčebné postupy a výsledky.

Poslední část bakalářské práce obsahuje seznam literatury, kterou jsem v bakalářské práci použil, dále seznam tabulek a obrázků použitých v práci a také seznam zkratek a dokument pro etickou komisi.

Klíčová slova: kolenní kloub, artoplastika kolene, celková náhrada kolenního kloubu, čéška, kolenní cvičení.

DECLARATION

I declare that the bachelor thesis was written by me independently and by supervising of PhDr. Mala Jitka, Ph.D. It is an original research, which refers to practice with patient after total knee replacement on left side, under supervising of PhDr. Maher Edwen, Ph.D. practice took place at CLPA Clinic in Prague.

I state that all information, examinations, and therapeutic procedures, which are presented in the bachelor thesis, were performed based on my knowledge that I got from professors of Charles University Faculty of Physical Education and Sport. Information used in writing the bachelor thesis were sourced from list of literature, which is placed at the end of the thesis.

Finally, I declare that there were no invasive methods used during clinical practice and that patient was fully aware of examinations and therapies at any time.

ACKNOWLEDGMENT

It’s my pleasure to have this space to thank so much all of my professors, who taught me for three years of my studying at Faculty of Physical education and Sport, special thanks to Doc. PaedDr. Dagmar Pavlu, CSc the head department of physiotherapy for her help and understanding during the years of study, special thanks for PhDr. Jitka Mala, Ph.D. who did and helped me a lot during my study, special thanks for my supervisor PhDr. Edwen Maher, Ph.D. Who lead my clinical practice at CLPA Clinic departemnt.

DEDICATION

I would like to dedicate the bachelor thesis to all whom I love especially to my family for their support all the time of my study abroad. And to my professors on our faculty who taught me a lot during the last three years of my study. I'm really grateful to you acquire the knowledge in physiotherapy

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Chapter 1: General overview of knee joint

Introduction

Currently surgery to replace the knee joint is one of the most frequently and successfully conducted orthopedic surgeries. It is a replacement of a joint that has lost its function by artificial, providing, thus, the recovery of limb function.

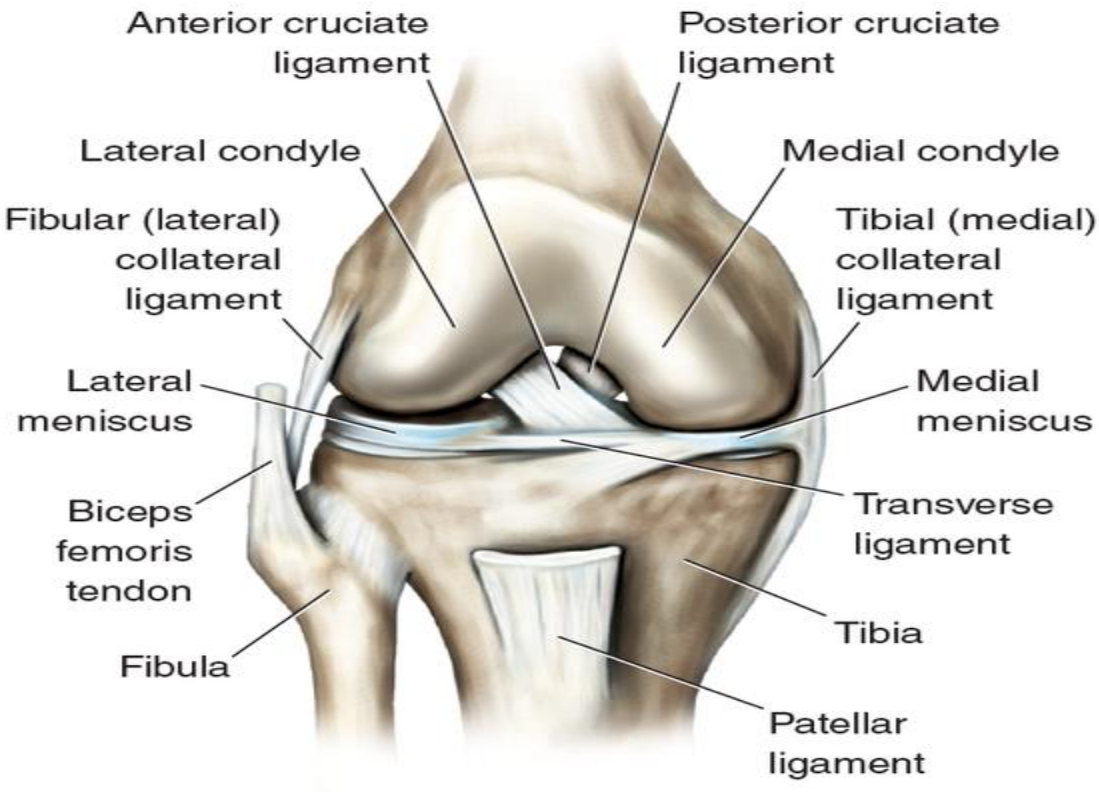
Knee replacement can be total, which means replacing all components (total joint replacement arthroplasty) and partial (hemiarthroplasty) is the replacement of only one particular surface or the inside of the joint degenerative - dystrophic diseases (arthrosis-arthritis), the rheumatoid arthritis, post-traumatic arthritis, improperly healed intra-articular fractures and damaged ligaments of the knee joint with marked changes in the articular ends of bones, etc.

Innovative technology of modern science allows today to use the most high-tech materials in medicine, implants to replace worn-out joints. Modern implants repeat all the lines the knee joint and allow the necessary range of motions.

Implantation of an artificial knee joint does not require extensive resection of bone during surgery and maintains a private ligamentous apparatus of the knee joint, except in cases where the ligaments are damaged and require restoration. Each case is matched with the corresponding prosthesis.

Knee replacement is an effective and often the only way to resolve the issue on recovery of lost limb function. The majority of patients report significant pain reduction and improved quality of life (Behnke, 2016).

1.1. Anatomy of the Knee Joint



Picture 1. Right knee joint, front view (Behnke, 2016).

Knee joint (articulatio genus) is the largest joint of the human body. It has a very complex structure: three bones are involved in the formation of the knee joint: the femur, tibia and the patella (Behnke, 2016).

1.1.1. The articular surfaces

Articular surface on the femur is formed by the medial and lateral condyles that have an ellipsoidal shape, and patella surface on the anterior surface of the distal epiphysis of the femur.

The upper articular surface of the tibia is presented by two oval depressions that articulate with the condyles of the femur.

The articular surface of the patella, that takes part in formation of the knee joint, is located on its rear surface and articulates only with patella surface of the femur.

The articular surfaces of the tibia and femur are augmented by intraarticular cartilage: medial and lateral menisci. They increase congruence of mating surfaces. Each meniscus is a fibrocartilaginous plate of semilunar shape, that in a cut has a shape of the

triangle. Thick edge of the meniscus is facing outwards and is adherent to the capsule, and thinned - inside the joint. The upper surface of the meniscus is concave and corresponds to the surface of the condyles of the femur, while the bottom is almost flat, lying on top of the articular surface of the tibia (Behnke, 2016).

1.1.2. The capsule of the knee joint

The capsule of the knee joint is large, but is quite thin. Joint capsule is attached a few indents from the edges of the articular surfaces of femur, tibia and patella. So, on the hip, in front, it rises up, bypassing the facies patellaris. On the sides it goes between the condyles epicondyle, leaving the latter outside the capsule for the attachment of muscles and ligaments. In the back, it is lowered until the edges of the articular surfaces of the condyles. In addition, the front synovium forms a large inversion, bursa suprapatellaris, highly extending between the femur and the quadriceps muscle of the thigh. Sometimes, bursa suprapatellaris can be closed and isolated from the cavity of the knee joint. On the tibia, the capsule is attached to the edge of the articular surfaces of the condyles. On the patella, it grows to the edges of the cartilaginous surface, so that it appears as if inserted into the anterior part of the capsule, as in a frame. On the sides of the joint there are collateral ligaments, running perpendicular to the frontal axis: the medial side, lig. collaterale tibiale (from epicondylus medialis of the thigh to the edge of the tibiae, growing together with the capsule and medial meniscus), and lateral, lig. collaterale fibulare (from epicondylus lateralis to the head of the fibulae). On the back of the capsule of the knee joint, there are are two ligaments, woven into the rear wall of the capsule - lig. and popliteum arcuatum lig. popliteum obliquum (one of 3 ultimate bundles of the tendon m. semimembranosi) (Behnke, 2016).

1.1.3. Ligaments

Ligaments are dense formations of connective tissue, which are necessary for fixing the ends of the bones with each other. Within each knee joint, there are the lateral and medial collateral ligaments in the side parts. They additionally strengthen the joint capsule, limiting the lateral movement in the knee joint (Hyde et al., 2007).

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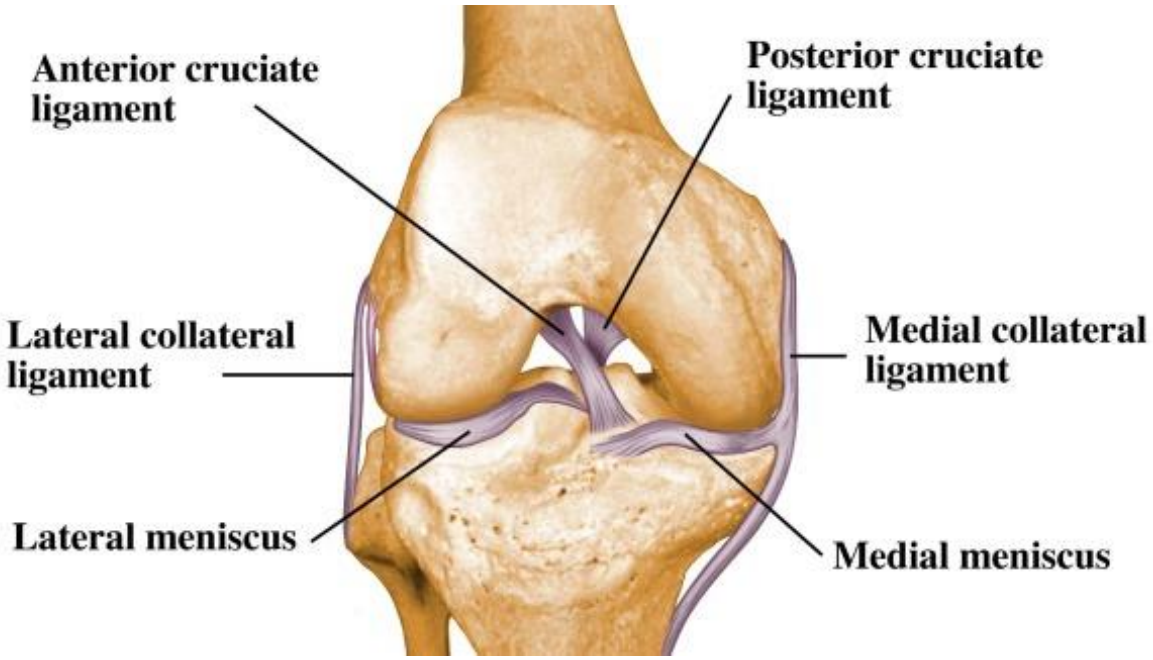

Picture 2. Ligaments (New Health Advisor, 2016)

The outer or lateral collateral ligament fibula begins from the outer epicondyle (bony protuberance) of the femur. It covers and strengthens the knee joint on the side. Below this, ligament attaches to the head of the fibula. From the joint of the outer lateral, ligament separates the layer of fatty tissue.

Internal tibial or lateral collateral ligament starts from the inner condyle of the femur. It has the appearance of a wide band, covers and strengthens the inner surface of the knee joint, and the bottom is attached to the tibia. In addition, some fibers of the internal lateral ligament are woven into the joint capsule and into the tissue of the internal meniscus of the knee joint.

Anterior and posterior cruciate ligaments are stretched inside the knee, between the articular surfaces of the femur and tibia bones. These ligaments limit excessive movement of the articular surfaces of bones in the anteroposterior direction. The anterior cruciate ligament keeps the tibia from slipping forward relative to the femur. Posterior cruciate ligament keeps the tibia from slipping backwards relative to the femur.

In the composition of the anterior cruciate ligament emit two beams: forward-internal and postero-lateral. This structure of the anterior cruciate ligament provides better stability in the knee joint at different flexion angles (Hyde et al., 2007).

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Front-internal beam is one and a half times longer than posterior-external (on average 37,7 mm vs. 20.7 mm) and wider (8.5 mm and 7.7 mm). When the knee is straightening, they are almost parallel to each other. If the knee is bent, front inner beam is lengthened, and the rear-outer - shortened.

Apart from the fact that the anterior cruciate ligament of the knee joint performs a stabilization function (keeps the tibia from shifting forward and medially), it still has the nerve endings which indicate the position: either a flexed or extended knee joint (Hyde et al., 2007).

The anterior cruciate ligament has virtually no blood vessels.

Cruciate ligaments provide control over the movements of the knee joint during movement back and forth. All the ligaments of the knee joint are highly important structures that provide stability of the knee joint (Lusardi et al., 2007).

Two connective-tissue formations of the knee, like ligaments, are called menisci. They are located between the femur and tibia. The menisci are sometimes referred to as the "cartilage" of the knee joint, however, the structure of the meniscus differs from the structure of the articular cartilage covering articular surfaces of bones.

The function of the meniscus:

• distribution of body weight over a larger area of the tibial plateau

• increasing of stability of the knee joint

The biomechanics of the knee joint is easier to consider, if to think of this joint as a ball, located on a flat area. The ball is the articular end of the femur and the flat area is the tibial plateau. Menisci are elastic strips that fill the space between femoral condyles and tibial plateau. They help to rationalize the body weight from the femur to tibia.

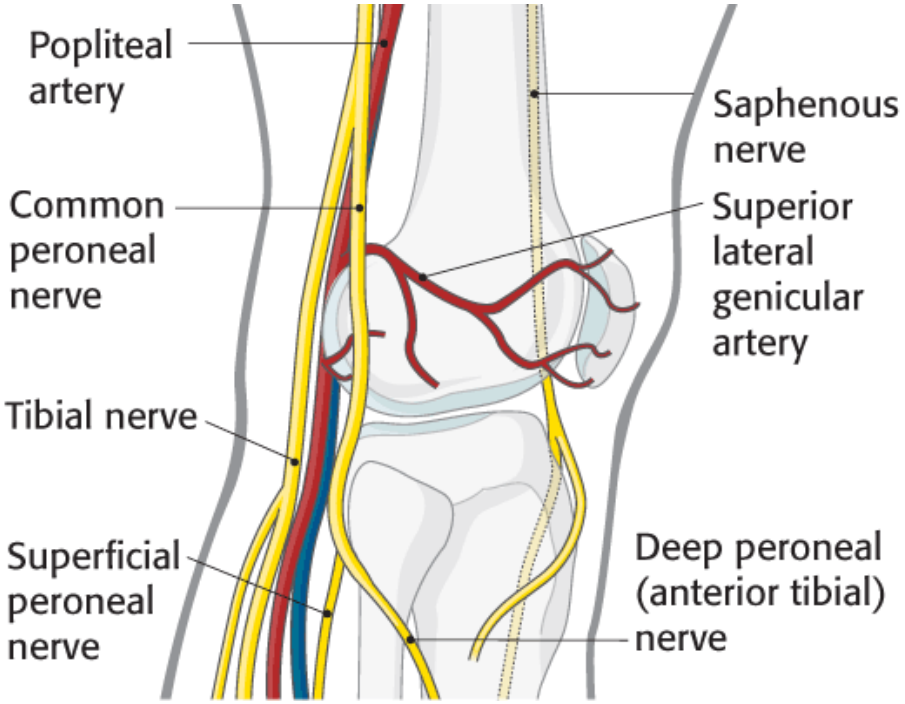
In the absence of the menisci, the entire body weight is distributed least at one point of the tibial plateau. The menisci also distribute the weight almost over the entire area of the tibial plateau. This role of the menisci is very important because they help to protect the articular cartilage from excessive loads. Damaged or missing menisci lead to an incorrect load distribution in the knee joint, which contributes to the development of degenerative changes of the articular cartilage (Lusardi et al., 2007).

In addition to the protection function of the articular cartilage, menisci along with the ligaments enhance stability of the knee joint. Joint stability is provided by its "unjamming" by menisci, that have a wedge shape. The thickness of the menisci is bigger on the periphery than in the central part. This geometry leads to the formation of shallow depressions on the tibial plateau. Such a surface gives more stability to the joint, as well as redistributes static and dynamic loads on the articular surface of the tibia more effectively.

Thus, the ligaments and menisci of the knee joint are highly important structures that contribute to stabilization of the joint. Without strong ligaments connecting the femur and tibia, the knee joint would be very unstable (Johnson et al., 2007).

1.1.4. Vessels and nerves of the knee joint

The blood supply of the knee joint is posble due to the extensive vascular network, rete articulare genus, formed mainly by branches of the four large arteries: the femoral (Genus descendens), popliteal (two upper, one middle and two lower articular), deep femoral artery (perforating and other branches) and the anterior tibial artery (Recurrens tibialis anterior) (Terfera et al., 2016).



Picture 3. Veins in knee joint (AO foundation, 2016).

These branches anastomose extensively with each other, forming a vascular plexus. There are 13 networks, located on the surface of the joint and its departments. The arterial network of the knee joint is important not only for circulation, but also in the development of collateral circulation in ligation of the main trunk of the popliteal artery.

The nature of the anatomical structure and peculiarities of the branching of the popliteal artery can be divided into three sections.

The first section is above the upper articular arteries, where ligation of the popliteal artery gives the best results for the development of roundabout blood circulation because of the inclusion of a large number of vessels, belonging to Femoralis and Profunda femoris system.

Second section is on the level of the articular arteries of the knee, where the popliteal artery ligation also gives good results due to the adequacy of collateral vessels.

Third section is below the articular branches; the results of ligation of the popliteal artery in this section are extremely unfavorable for the development of the roundabout circulation.

In the knee, the superficial veins are especially well developed on the anterior-surface. The superficial veins are arranged in two layers. More superficial layer is formed by the venous network extension from the great saphenous vein, a deeper layer is due to the great saphenous vein.

The additional great saphenous vein occurs in 60% of cases. It goes from the shin to the thigh, parallel to v. Saphena magna and flows into it in the middle third of the thigh.

Small subcutaneous vienna collects blood from the rear surface of the joint. V. Saphena parva most often goes with a single trunk and rarely with two. Place and level of the confluence of Saphena parva vary. V. Saphena parva may fall into the popliteal vein, femoral vein, long saphenous vein and a deep muscle vein. In 2/3 of all cases, v. Saphena parva empties into the popliteal vein. Anastomosis between v. Saphena magna and V. Saphena parva is typical. The deep veins of the knee include the popliteal vein, v. Poplitea, extension, joint and muscle veins (Weiss et al., 2012).

Additional branches of the popliteal vein are found in 1/3 of all cases. They represent veins of small caliber, located on the sides or one side of the popliteal vein. Joint and muscle veins accompany arteries of the same name (Weiss et al., 2012).

1.2 Biomechanical view of the knee joint

1.2.1 Introduction

The knee joint is among the body's largest joints which consist of four bones and a broad network of muscles and ligament (Potocnik et al., 2008). The bones, menisci, cartilage, joint capsule, muscles, ligaments and tendons in the knee joint uniquely interact to provide mobility and support. The joint knee is likely to experience injuries in various activities thus understanding its biomechanical view is crucial in knowing any ensuing pathology. The knee joint experience injuries because it has the role of transferring body weight and it has various muscles while at the same time generating flexible movement.

1.2.2 Biomechanics of the Knee Joint

Biomechanics is the science of action of the forces in a living body. All joints have a core responsibility of allowing motion of the bony segments which surround that particular joint while at the same time withstanding weight against gravity which these movements impose. There is a complex interaction between the patella, tibia, and femur which allows the knee joint the ability to withstand tremendous forces during the regular ambulation phases (Sanchez et al., 2006). The knee joint has to provide a healthy amount of motion without having to sacrifice its stability during the static activities like jogging, walking, pivoting, running, and descending or ascending the stairs.

1.2.3 Passive Knee Motion

The knee joint allows both extension and flexion motion. The knee joint can average from 0-135° when flexing in the sagittal plane. Additionally, the structure of the articular surfaces, soft-tissue capsule, as well as the ligaments often commands the passive

motion that the knee joint make. As a result, there is a distal asymmetry between the lateral and medial condyles. Motion between the 20° of full extension and flexion is accompanied by lateral femoral condyle posteriorly rolling which is more than that of the medial femoral condyle. It allows unlocking of the tibia and femur from full extension. This occurs without the help of the active muscle involvement. Knee joint passive flexion occurs after 20 degrees of flexion through a sliding motion with a relative tibial femur movement (Potocnik et al., 2008).

1.2.4 Joints at the Knee Complex

There are the tibiofemoral joint and the patellofemoral joint at the knee complex. The tibiofemoral joint is also known as the knee joint, and it is the primary joint at the compound of the knee. The proximal component of the tibiofemoral joint is the femur, and it forms a convex femoral condyle. Its distal element is the tibia which is the tibial plateau concave superior surface. This joint has to types of motions which include the convex and the concave. There is the knee flexion which is also the anterior glide of the femoral condyles' tibial plateau (Potocnik et al., 2008).The tibia inward which is an outward rotation that only occurs when the knee is in a flexed position. The other types of motions at the knee joint is the resting position and the closed –packed position. With the resting position, there is a slight knee flexion at 10 degrees which there is a full knee extension at the closed-packed position.

1.2.5 The ACL and PCL

The knee PCL and ACL ligaments have the role of restraining posterior translation and anterior translation of the tibia about femur respectively. According to Grood (1991), both the anterior and posterior cruciate ligaments act as secondary restraints when there is varus as well as valgus rotation. Again, the anterior cruciate ligament limits excessive rotation of the valgus knee whereas that of the posterior cruciate ligament restraints varus

rotation particularly when there is bigger knee flexion angle, that is, above 60 degrees (Sanchez et al., 2006). The ACL restrains internal tibial rotation.

1.2.6 Biomechanical View of the Knee Joint Ligaments

1.2.6.1 Anterior Cruciate Ligament Biomechanical View

The two major ligaments include the anterior and posterior cruciate ligaments. During full extension, the ACL has the potential of absorbing 75% of anterior translation weight and 85% of the load between 30- 90 degrees of flexion. When there is a loss or damage to the ACL, there is a decrease in the rotation magnitude during flexion leading to an unstable knee. From the past studies, there are impossibilities in the uniform testing of ACL's orientation and strain rates. Both the lateral and medial anterior bundles have a higher tension and maximum stress that the posterior bundles. The ACL has a tensile strength of approximately 2, 200 N which can experience alteration with repetitive loads and age. There is an increase in the ACL in situ force when the anterior force magnitude increases (Sanchez et al., 2006).

1.2.6.2 Posterior Cruciate Ligament Biomechanical View

The PCL has the potential of resisting tibial posterior translation on the femur at all knee flexion positions. It acts as a secondary stabiliser against any tibial external rotation and excessive valgus or varus knee angulation. There is an anterolateral band found tightly fitted in the flexion and it resists posterior tibia displacement in 70-90 degrees of flexion. During extension, the posteromedial portion becomes tight thus managing to resist posterior tibia displacement. When there is isolated PCL ruptures, there might be mild increase external rotation of the knee flexion at 90 degrees. They do not cause an alteration in the valgus/varus angulation or tibial rotation since there are intact ligaments and other capsular tissues. According to Harner et al.(1995), the anterolateral

component has a tensile strength and greater stiffness than the meniscofemoral ligaments and the posteromedial bundle. The popliteus muscle is present to aid the PCL in enhancing stability and resisting posterior tibial translation. When there is a PCL –deficient knee, the popliteus muscle reduces tibia posterior translation by 36%.

1.3 Kinesiology View of the Knee

1.3.1 Introduction

. The knee can be said to be a semi –hinge joint which permits extension and flexion and limited internal-external rotations and varus-valgus (Woo et al., 2006).

1.3.2 Bones of the Knee Joint

The knee has four main bones which include the patella (kneecap), fibula (outer shin bone), tibia (shin bone) and femur (thigh bone). The knee joint's axial movement takes place between the patella, femur and tibia. Each bone has an articular cartilage cover which decreases any frictional force when there is movement between the bones (Woo et al., 2006).

1.3.3 The Knee Joint Capsule

It is a compact ligamentous structure which is surrounding the entire knee and inside it has an individual membrane known as the synovial membrane which has the role of providing nourishment to the structure of the knee. The surrounding ligaments strengthen the capsule itself (Woo et al., 2006).

1.3.4 Knee Joint Muscle Groups

The hamstrings and the quadriceps are the two major knee muscle groups. Both have a significant role as they stabilize and move the knee joint. The quadriceps muscle groups consist of four dissimilar individual muscles that link to form the quadriceps tendon. The think tendon connects different muscles to the patella. The patella connects

those muscles to the tibia through the patellar tendon. Knee extension takes when there are quadriceps contractions which pull the patella upwards. The hamstrings provide stability on the joint line, and they also flex the knee joint (Woo et al., 2006).

1.3.5 Knee Ligaments

. The ligaments are crucial since they enhance knee stability. Each ligament plays a particular role in helping in the maintenance of maximum knee stability while in different positions. The Medial Collateral Ligament which runs between the tibia and femur inner surfaces helps in resisting any acting force from the knee valgus outer surface. The Lateral Collateral Ligament runs from the femur outer portion then to the fibula's head, again it has the potential of resisting any effects that arise from the forces of the knee varus surface. There is the presence of the Anterior Cruciate Ligament which experiences injuries when there is a twisting movement. The knee has cartilage menisci which act as the knee's shock absorbers and also allows for correct distribution of weight between the femur and the tibia (Otake et al., 2007).

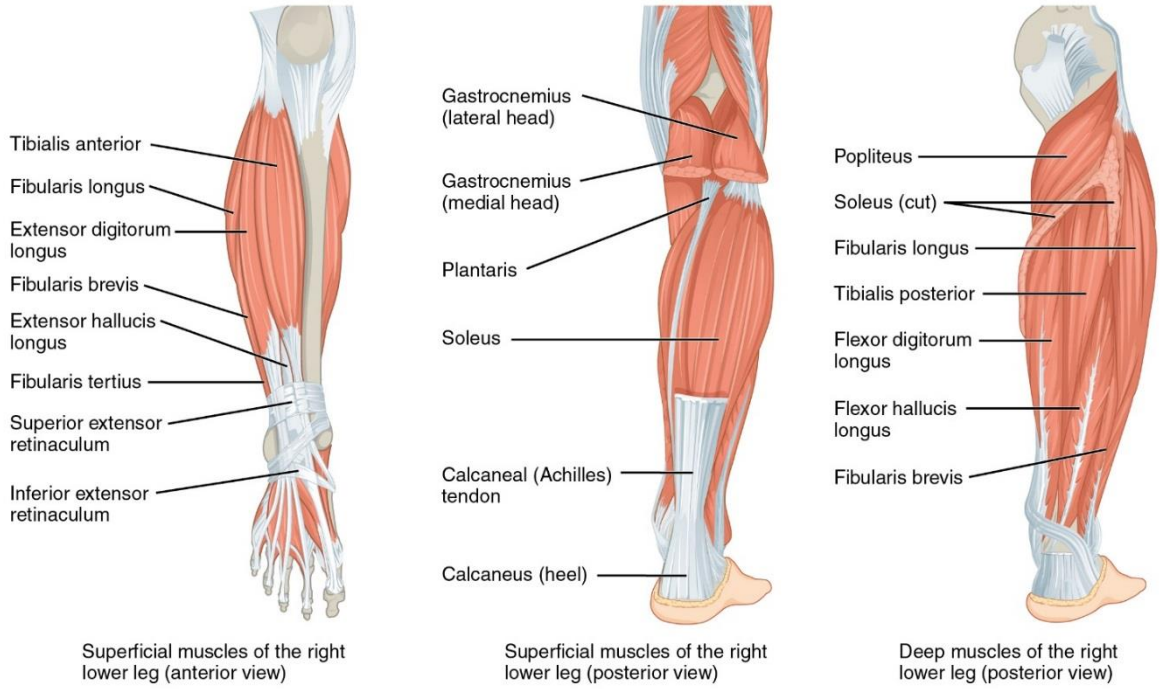
1.3.6 Extension of the Knee

In the process, the quadriceps are the prime movers. The quadriceps include; vastus lateralis, vastus intermedius, rectus femoris as well as vastus medialis. In knee extension, there are no true synergists. However, the soleus and gluteus Maximus can be knee extension synergistic when there is a closed chain mechanics. The Sartorius, biceps femoris, semitendinosus, semimembranosus, gracilis and gastrocnemius are the antagonists. A careful balance should exist between the knee lateral portion and medial stabilisers in preventing excessive external or internal rotation of the tibia. During knee extension, there are three types of stabilisers which include the media stabilisers, lateral stabilisers and popliteus, articular knee muscle (Sanchez et al., 2006). The examples of medial stabilisers are pes anserinus group, vastus medialis obliqus and medial

gastrocnemius. The lateral stabilisers include plantaris, biceps femoris, gluteus Maximus, TFL, etc. The fixators include all muscles of the ankle.

1.3.7 Knee Flexion

Just like the knee extension, the knee flexion has got the prime movers, synergists, antagonists, neutralizers and stabilisers (Woo et al., 2006). The prime movers include the semitendinosus, semimembranosus and biceps femoris. The synergists consist of Sartorius, popliteus and gracilis. The quadriceps are the antagonists. The neutralizers are present to bring balance between the lateral and medial stabilisers. The medial stabilisers which are present are the Pes Ans.



Picture 4. The muscles (Angelo, 2016).

1.3.8 Conclusion

The knee entails four bones namely the tibia, femur, patella and fibula. There is also an extensive network of muscles and ligaments in the knee. Additionally, the joint capsule of the knee provides strength to the surrounding ligaments. There are four types

of ligaments, and each has got its particular function at the knee. The knee muscles provide stability. There are knee flexion and extension. Flexion is the decreasing or bending angle between the leg and the femur while the extension is the increasing or straightening of the angle between the lower leg and the femur.

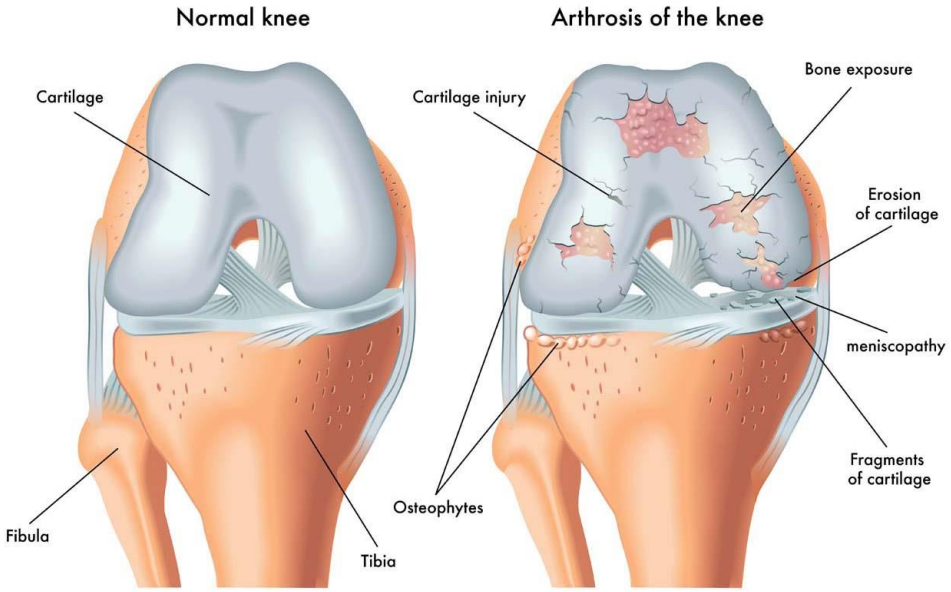
Chapter 2: Knee diseases

The pain in the knee is discomfort that many people face during walking, exercise and even at rest.

Discomfort can be caused by trauma or the following diseases:

• Gonarthrosis • Meniscopathy • Arthritis • Periarthritis • Tendinitis of the knee • Rheumatoid arthritis • Bursitis • Gout of the knee joint • Paget's Disease • Fibromyalgia • Osteomyelitis • Baker's Cyst • The Koenig disease • The Osgood-Shlatter Disease • Infectious diseases of the knee joint: Lyme disease, Reiter's syndrome.

2.1. Gonarthrosis is a breakdown of cartilage of the knee joint, resulting in its deformation and dysfunction. Gonarthrosis affects women more often than men. It is also called osteoarthritis of the knee (Bonnin et al., 2008).



Picture 5. Arthrosis (Silvester, 2016).

In accordance with the causes, there are two types of the disease. A contributing factor to the development of primary or idiopathic gonarthrosis, is the advanced age of the patient. Precise external causes are not yet known. This type of disease is bilateral, i.e. affects both legs. The second type of gonarthrosis is caused by injury of the knee joint or as a complication of infections. It can develop in a patient at any age and can be both unilateral and bilateral.

The main reasons for the development of gonarthrosis are fractures of the knee joint, arthritis, tumors of bone, arthrosis and spondylitis.

The disease develops gradually and practically does not appear at the first phase. Among its key symptoms – acute pain in the knee after being in a state of rest, changes in gait. Gradually during the movement, the discomfort passes, but after a long rest it comes back again. Gonarthrosis can cause osteophytes - the so-called growth of bone tissue. As a result of friction of cartilage tissue with these structures, membrane of the joint becomes inflamed. The skin on this spot is redder, the tumor appears and the patient has a fever.

Stage of gonarthrosis:

• Deformity of the joint is almost invisible. Occasionally, light pain may be experienced;

• At this stage, deformation is clearly visible. The pain intensifies, bouts became longer. Crunch in the knee joint is possible;

• The disease progresses rapidly. Now, the pain is felt both during movement and at rest, gait changes.

Gonarthrosis is diagnosed on the basis of x-ray and visual inspection of the knee joint. It is recommended to perform a leg massage to improve circulation. This will reduce the pain. Analgesics help to get rid of pain. Chondroprotectors affect the cartilage. In the third stage of the disease, surgical intervention may be required. Hip replacement allows to replace the knee joint, fully restoring all of its features. With arthroscopy, it is possible to slow the progression of gonarthrosis (Bonnin et al., 2008).

2.2. Meniscopathy

There are two special cartilage pads in the knee joint that ease the load on the joint at the time of active movements. They are called menisci. The medial or inner meniscus is damaged less frequently than the lateral, known as the outer. Such injury may occur to people regardless of age and occupation. to jumping, squats, skiing contributes to the development of meniscopathy. Those, who suffer from gout or arthritis, diabetes, has weak ligaments, or excessive weight that increases the load on the joints are at risk.

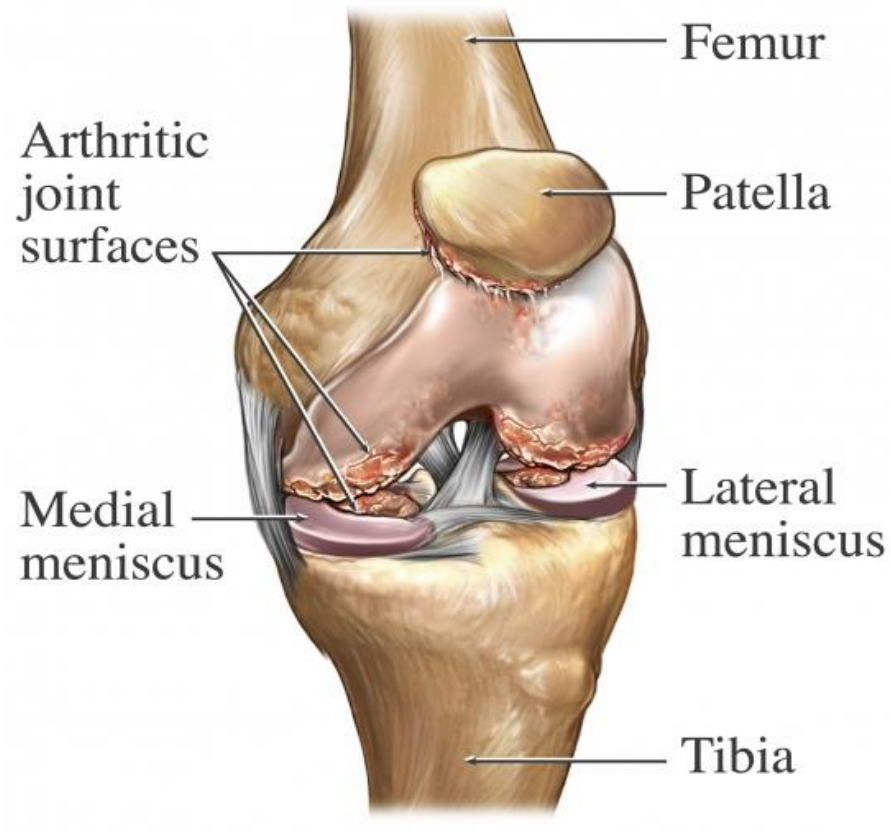
The main symptom when the meniscus is damaged is a click in the knee joint, and then sharp pain. The younger the person, the more he feels. In elderly age, the cartilage is not enough saturated with moisture, so the feeling is weaker. With the appearance of severe pain, the patient stops the movement. Gradually, the discomfort passes, and then again the man can hardly walk. The next day, the knee swells, but it is a defensive reaction aimed at restoring the compressed meniscus after injury. Otherwise, the disease becomes chronic. The duration of the attack of pain lasts for a few weeks. During this time, the swelling goes away. In the absence of necessary treatment, meniscopathy periodically manifests itself by attacks of severe pain and eventually can lead to osteoarthritis.

The most reliable method of diagnosis is magnetic resonance imaging. It determines the nature and degree of damage to the meniscus. If it is completely torn, surgery is needed. The surgeon completely removes the meniscus or part of it. Therapeutic methods are effective in jamming or breakdown. A few sessions with a trauma specialist or a chiropractor can restore the function of knee joint. Corticosteroids and nonsteroidal

anti-inflammatory drugs help to remove swelling. However, at first, the cause of the tumor should be eliminated (Bonnin et al., 2008).

2.3. Arthritis

Arthritis is considered the most common form of the disease of knee joint. It involves the defeat of the synovial membrane, capsule, cartilage. If this disease remains untreated, the patient may lose the ability to walk and actively move (Johnson, 2011).



Picture 6. Arthritis (Louis, 2010).

Arthritis can be of the following types:

• rheumatoid - factors that contribute to its development are unknown;

• post-traumatic – is the result of sprains, bruises, tears, damage to the menisci;

• reactive – the reason for its appearance is considered to be food poisoning, infection of the tissues;

• deforming – occurs when blood circulation is violated;

• gout – caused by a malfunction in metabolism in the body, deposits of urate of sodium.

In addition, arthritis can be primary when it occurs as a result of injury and development of infection, or secondary, when the inflammation occurs in other tissues, and the knee gets with the lymph or blood (Johnson, 2011).

Excess weight increases the load on the joints, and old age, as over time the cartilage and bone wear – all these contribute to the development of the disease. Significant physical strain, frequent lifting, immunodeficiency also lead to arthritis.

Bouts of the disease are accompanied by unpleasant feelings in the knee, redness, swelling. They became longer and more painful as the arthritis develops. During the formation of pus, the patient has a fever.

Treatment involves measures aimed at the elimination of puffiness, discomfort, restore function of the knee joint, preventing new attacks. Relief from pain is possible by using non-steroidal anti-inflammatory drugs and analgesics. Warming and distracting ointments and tonic preparations are also effective. Physiotherapy techniques, massage and therapeutic gymnastics are appointed in remission. If conservative treatment does not produce the necessary results, surgery is required (Johnson, 2011).

2.4. Periarthritis

This disease affects periarticular tissue: muscles, ligaments, tendons, the joint capsule. The cause of its development become chronic diseases, frequent hypothermia, problems in the endocrine system, peripheral vessels. Post-traumatic periarthritis appears as a result of damage to the joints.

This disease is characterized by aching pain in the knee joint, the formation of edema. During the examination, the doctor can detect the presence of nodules and small seals. Pressing on them causes severe pain. There is discomfort in the knee joint during walking.

It is recommended to limit movement and often lie dormant during treatment. To relieve inflammation and reduce pain, non-steroidal agents, for example, diclofenac are allowed. Physiotherapy is an essential part of the treatment. Another most common

ways are – local cryotherapy, infrared laser therapy, imposition of paraffin-ozocerite applications. It is necessary to improve the condition of the periarticular tissues.

Older women often suffer from a special form of this disease – periarthritis of synovial bursa . It involves inflammation of the knee tendons from the inner side. Swelling and joint strain does not occur. The pain is felt only during movement on uneven surfaces, wearing shoes with high heels. If the disease is diagnosed in time, in the early stages of development it can be cured quickly. This could be done through physiotherapy and special drugs.

2.5. Tendinitis of the knee

It is inflammation of the tissue of the tendon in the area of its attachment to the bone or in the area of muscle-tendon transition. This disease is known as "jumper's knee". This is largely due to the fact that the cause of tendonitis can be engaging in such sports as basketball, cycling, volleyball. Athletes, older people, adolescents and children are most susceptible to disease. It affects the patellar ligament, responsible for the implementation of flexor and extensor movement. Tendonitis may appear only on one foot or on both at once and comes in two forms: endobenthic and tenosynovitis. In the first case, the tendon bag inflames, and the second - the tendon sheath (Maffulli et al., 2005).

The causes of tendonitis are:

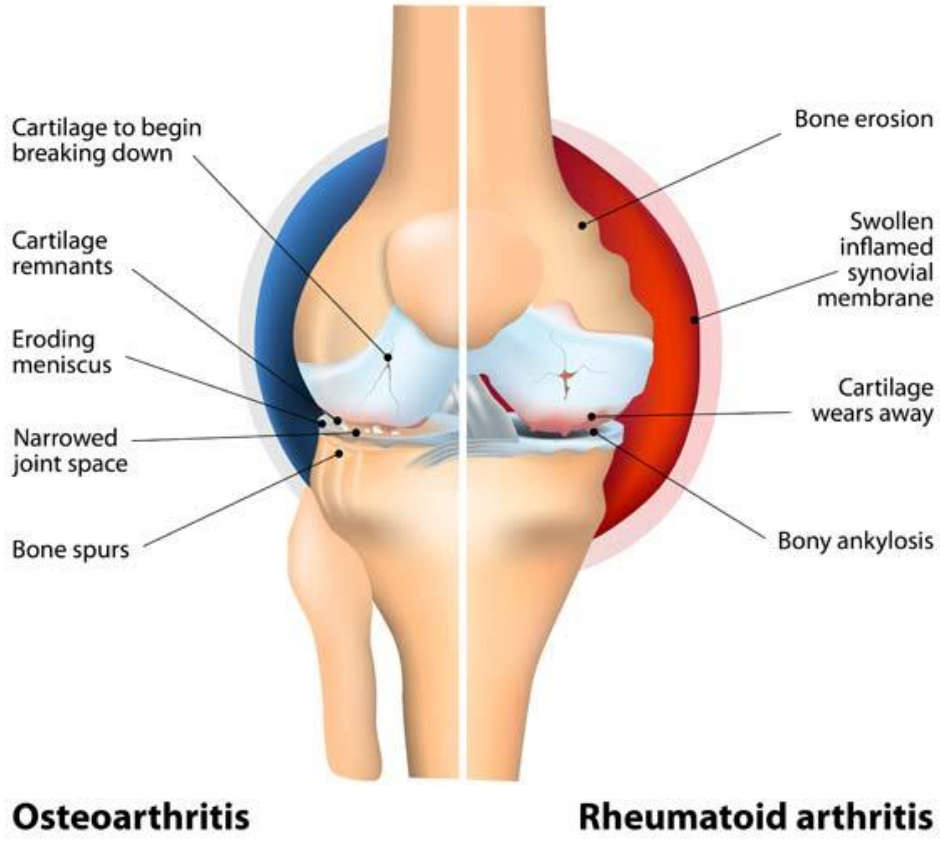
• other diseases (gout, rheumatoid arthritis) • injuries, sprains, bruises • uncomfortable shoes • muscle imbalance • weak immune system • regular physical activity • fungal infection, parasites.

Tendonitis pain often appears when the weather changes. The knee joint is swollen, there is a limitation of its mobility, and creaking is heard while moving. Active motion provokes attacks of pain. In the later stages of tendonitis, there can be rupture of the ligaments of the patella.

During X-ray, the disease reveals only when the cause is the deposition of salts, bursitis or arthritis. Laboratory studies in the diagnosis are efficient when tendonitis occurs as a complication after an infection. Different types of scans allow to obtain detailed information about the deformation of the tendons (Maffulli et al., 2005).

In the early stages of the disease, it is possible to manage conservative methods of treatment. The patient should limit physical activity. In some cases, immobilization of the knee joint is required, so cast or langedoc are used. The doctor prescribes medications (nonsteroidal, anti-inflammatory) and physiotherapy. In critical situations, injections of corticosteroids and antibiotics are required. Magnetic physical therapy, iontophoresis and electrophoresis are often used. In the last stages of tendinitis, degenerative tissue is surgically removed. When the pus in the knee accumulates, the autopsy and its pumping is performed. For best results, medication is combined with use of traditional medicine. It is also advisable to perform physical exercises under the supervision of a coach. After recovery, the patient can get back to normal sports. Yoga has positive impact on the state of the knee joint with tendinitis (Maffulli et al., 2005).

2.6. Rheumatoid arthritis



Picture 7. Osteoarthritis and rheumatoid arthritis (Nordqvist, 2016).

Rheumatoid arthritis represents a disease of a systemic nature and manifests itself in the form of inflammation of the connective tissue. The exact causes of its appearance are not known. There is a genetic predisposition to rheumatoid arthritis. In the

moment of weakened immunity, the disease begins to develop. It affects both men and women at any age. It affects the connective tissue in the joints, which account for a significant load, including the knee. The lack of timely diagnosis and treatment of rheumatoid arthritis in most cases leads to disability and even death (from infectious complications and renal failure) (Nordqvist, 2016).

There are factors that contribute to the development of rheumatoid arthritis. These are constant emotional stress and frequent hypothermia.

In accordance with the symptoms, the following stages of development of rheumatoid arthritis are distinguished:

• There is swelling of the knee joint. The patient experiences pain. Body temperature may increase;

• Inflamed cells are actively dividing. This causes compaction of the synovial membrane;

• At the last stage, bone and cartilage are affected. The knee joint is deformed and does not perform its functions. The attacks of pain become stronger and longer.

Rheumatoid arthritis develops slowly. The first time may occur only in the form of stiffness in the knee after being dormant for a long time, for example, in the morning upon awakening. The pain occurs at night and when there is a sudden change in the weather.

The disease is diagnosed on the basis of biochemical blood analysis, X-ray and expressed outwardly symptoms: skin redness, swelling, joint strain, pain in it. If the arthritis is caused by an infection, then antibiotics are appointed. To relieve pain and inflammation, corticosteroids and nonsteroidal anti-inflammatory drugs are used. Physiotherapy and regular massage is also required (Nordqvist, 2016).

2.7. Bursitis

The inflammation that occurs inside the synovial bags is called bursitis. Its reason is the accumulation of fluid, i.e. fluids containing dangerous microorganisms. Bursitis occurs as a result of injury of the knee joint, significant physical exertion or as a complication of infectious diseases. Arthritis or gout also contribute to its development.

Bursitis can be identified by stiffness in the limbs, pain in the knee. Inflammation is especially noticeable after pressing motions on the skin. The patient experiences weakness, malaise, and may lose appetite. If the cause of the bursitis was an infectious disease, body temperature is raised. Its important distinction from arthritis – maintaining the ability to make bending-extensor movements (Kanis, 1998).

During diagnosis, the doctor examines the symptoms. Biopsy is needed for determining the exact nature of accumulated fluid. In the early stages of the development, bursitis can be treated with compresses, wraps. The patient must comply with bed rest. In chronic bursitis, a puncture is made to remove accumulated liquid inside the bag, and the cavity is rinsed (Kanis, 1998).

2.8. Gout of knee joint

It is a chronic disease associated with deposits of sodium that provokes attacks of acute pain in the knee joint. Gout is more common in men than in women. The reason for its development is considered to be a violation of urinary metabolism, resulting in increased blood levels of uric acid. Eating excessive amounts of foods containing purines leads to this. These include meat and fish. Alcohol abuse also contributes to the development of disease.

Gout is manifested in the form of a sharp pain in the knee joint and redness of the skin in this area. Dense nodules – tophi are formed in the soft tissue. They represent the accumulation of uric acid. Sometimes tophi are torn, and they go out. Attacks of pain during gout can last several days or even a week.

Defining gout is possible if the biochemical analysis shows high content of uric acid in the blood. Also, radiography is a part of diagnosis. Diet and less movement helps to cope with a gout attack. The patient should be provided with emotional and physical rest. Diet is combined with drug therapy (Kanis, 1998).

2.9. Paget's Disease

The violation of the processes of bone formation leads to skeletal deformities, bone fragility. In medicine, this phenomenon is called Paget's disease. It affects the long bones of the legs and can cause pain in the knee joint. In men, Paget's disease is detected more often than in women. It usually occurs in people in old age.

Determining the presence of this disease is difficult, as it may not be accompanied by any symptoms. In some cases, patients may experience pain at night, and warm is felt on the place of affected bone. Biopsy, x-rays and biochemical analysis of blood which shows a high content of phosphatase is used for diagnosis of Paget's disease (Kanis, 1998).

Non-steroidal and anti-inflammatory drugs are used to ease the pain. Basically, treatment is aimed at preventing complications of Paget's disease: increased bone strength, reducing fragility. This is possible due to taking bisphosphonates, and drugs, serving as a source of calcium. The patient should be regularly tested and observed by a doctor. In severe cases, the rehabilitation in the clinic is required. During Paget's disease, it is required to follow a diet, conduct physical education classes under the supervision of a specialist and avoid falls and injuries. Because of the fragility of the bones, the probability of fractures is extremely big (Kanis, 1998).

2.10. Fibromyalgia

The disease can be found in at least 5% of the population. Fibromyalgia is expressed in the form of symmetrical musculoskeletal pain, often occurring in the knee. Its causes are poorly understood but it is known that the discomfort is not caused by inflammatory processes.

The main complaints in patients, in addition to musculoskeletal pain are poor sleep, fatigue, lack of energy, intestinal disorders, convulsions and spasms, numbness and morning stiffness. Common symptoms often cause a wrong diagnosis. Fibromyalgia can be confused with depression.

Emotional stress, accelerated metabolism of serotonin, physical injuries are considered the causes of the disease. Diagnosing of fibromyalgia is carried out by various methods and is chosen by the doctor individually. Often, the presence of the disease is determined even by excluding the presence of other ailments.

Treatment includes medicamental and non-medicamental methods. Antidepressants and painkillers are prescribed in most cases. It is recommended to avoid stressful situations, exercise, diet, conduct a massage (Kanis, 1998).

2.11. Osteomyelitis

It is a purulent-necrotic process of the bone and soft tissues around it. It is caused by special bacteria that produces pus. Infectious agents penetrate in different ways: the endogenous - through the blood, spreading from the source of inflammation, exogenous - as a result of treatment of fractures, fillings. Osteomyelitis may be caused by trauma or Staphylococcus aureus (Kanis, 1998).

2 main types of disease are allocated: hematogenous and traumatic. In the first case of osteomyelitis, it does not manifest itself outwardly for a long time. However, the patient may experience malaise, weakness. Then there is a sharp increase in body temperature and there is sharp pain. The inflammatory process occurs very quickly. Sepsis is possible, leading to death of the patient. Traumatic osteomyelitis develops when the treatment was started too late. Attacks of pain in this case alternate with rest.

Treatment of osteomyelitis is medical (with antibiotics) and surgical. During the operation, pus and dead skin cells tissue are removed (Kanis, 1998).

2.12. Baker's Cyst

Baker’s cyst is a popliteal knee hernia. Its size can vary, but rarely exceeds a few centimeters. Most often it occurs in people after 30 years and in children aged 3-7 years. Baker's cyst is formed due to damage to the knee. It also promotes the emergence of diseases such as arthritis and osteoarthritis.

Due to the small size, it can sometimes not be detected even by a doctor. It does not cause disturbance, changes in his health are not observed. Pain in the knee area, swelling, discomfort when performing anterior-posterior bending may be experienced. In some cases, the cyst eventually goes away.

Aspiration is performed when severe pain is present. It is also needed if the cyst is large. Non-steroidal drugs help to relieve pain, but they can be taken only under medical supervision. The imposition of compresses, exercises aimed at strengthening the knee allow to relieve the inflammation (Kanis, 1998).

2.13. The Koenig disease

This disease is often called the dissecting osteochondrosis. A section of cartilage may separate from the bone and move freely in the knee joint. This hampers

movement and causes pain. This phenomenon is called Koenig disease. Most often it occurs in the knee joint. There is the adult form of the disease, treatment of which is more complex, and child. The development of the Koenig disease has 4 phases.

Its symptoms include dull pain, synovial fluid accumulates in the joint. The discomfort is felt most strongly while moving. The separation of the cartilage exposes the bone, accompanied by inflammation, which is manifested by edema. Radiation is recognized as the most informative method of diagnosis in Koenig disease.

Conservative methods of treatment help on the initial stages. For elderly patients, and in the late stages, surgery is usually required. The patient needs physical and emotional rest (Kanis, 1998).

2.14. The Disease of Osgood-Shlyatter

This disease manifests itself in the form of painful lumps in the area of the kneecap. Children and adolescents suffer from it. Those, who are engaged in sports such as basketball, figure skating, ballet are at high risk of developing of the disease. Boys suffer more from the problems with the patella than girls. Doctors attribute this to the fact that they are subject to more strenuous physical activity than girls.

The main symptoms of the disease are: swelling in the knee area, sharp pain while moving, running, jumping. A marked tuberosity can be felt. The disease of Osgood-Shlyatter strikes, as a rule, only the knee of one leg.

It goes away with age. But in some cases it requires physical therapy or medical treatment, which involves taking painkillers. Cold compresses also help. The patient must use the knee strap when performing physical exercises. Physiotherapy helps to strengthen the tendon, but it should be carried out under medical supervision (Kanis, 1998).

2.15. Infectious diseases of the knee joint: Lyme disease, Reiter's syndrome

Lyme disease develops after a bite by infected tick. It becomes chronic and recurrent, as the pathogens reproduce in the body. The diagnose of disease is based on biochemical analysis of blood.

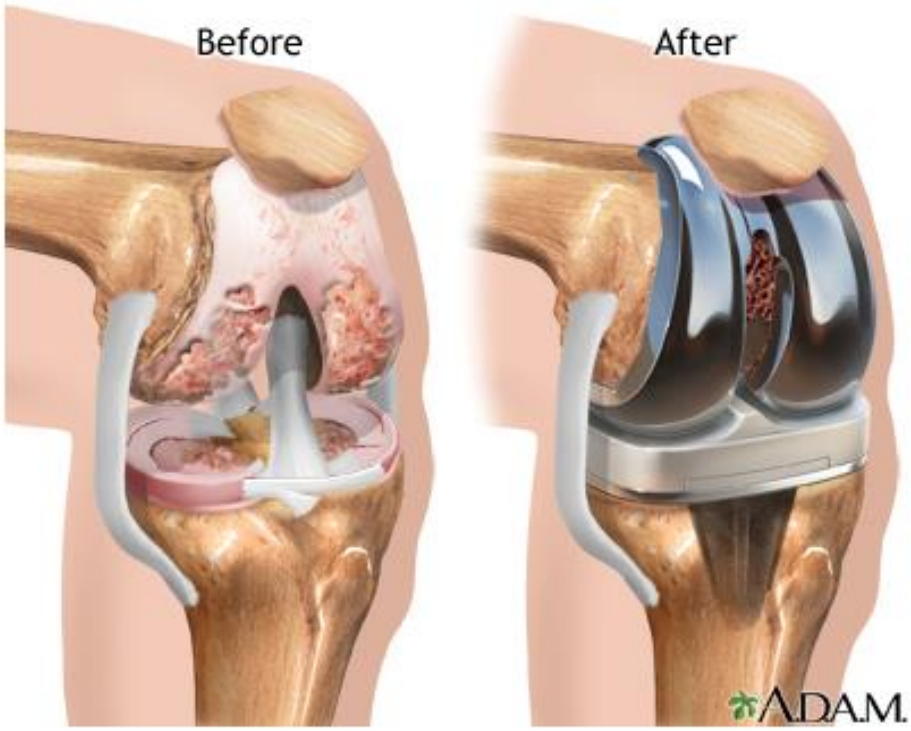
With Lyme disease, the patient experiences pain in the muscles and tendons. Most often it strikes knee joints. Possible symptoms are arrhythmia, headaches,

depression, weakness. When diagnosing, Lyme disease can easily be confused with other disease, so at the first suspicion, the patient should consult the doctor to confirm the infection and prescribe antibiotics (Kanis, 1998).

Reiter's syndrome is called the inflammation of the urogenital tract, eyes and joints, including knee. When urinating, patients feel itching, pain and burning. In the knee joints, they feel severe pain. The lesion is usually asymmetrical. Leather in the knee area becomes reddish and swelling is formed. The disease may have both acute and chronic form. The reason for it is a urogenital or intestinal infection. After the diagnosis, it is treated with non-steroidal anti-inflammatory drugs (Kanis, 1998).

Chapter 3: Knee replacement

The knee joint is one of the most complex joints in the human body, and it is very often subjected to damage. This affects the bone structure and capsular-ligamentous apparatus. Arthroscopic treatment technology is commonly used in acute injuries of the knee joint, but in the long term often raises the question of the replacement joint (Scuderi et al., 2002).



Picture 8. Knee before and after the surgery (Miller, 2016).

Indications and contraindications to knee replacement surgery

Some diseases of the knee joint deliver terrible inconvenience, and anguish to their owners. Pain worsens during walking and during changing weather conditions. Gait changes, limited mobility, appears limp. The surgery is performed to replace the knee joint in patients with the following diseases:

• Osteoarthritis (salt deposits) • rheumatoid arthritis (inflammation of the small joints) • functional disorders of the extremities • aseptic necrosis (necrosis of bone tissue) • previous injuries.

Orthopaedic surgeons are constantly improving their skills and gaining experience, since technology is being upgraded continuously. Analysis and research in the field of prosthetics are conducted, the best modern materials are used. However, no matter how good is the doctor, and no matter how expensive the prosthesis, there are contraindications for surgical intervention:

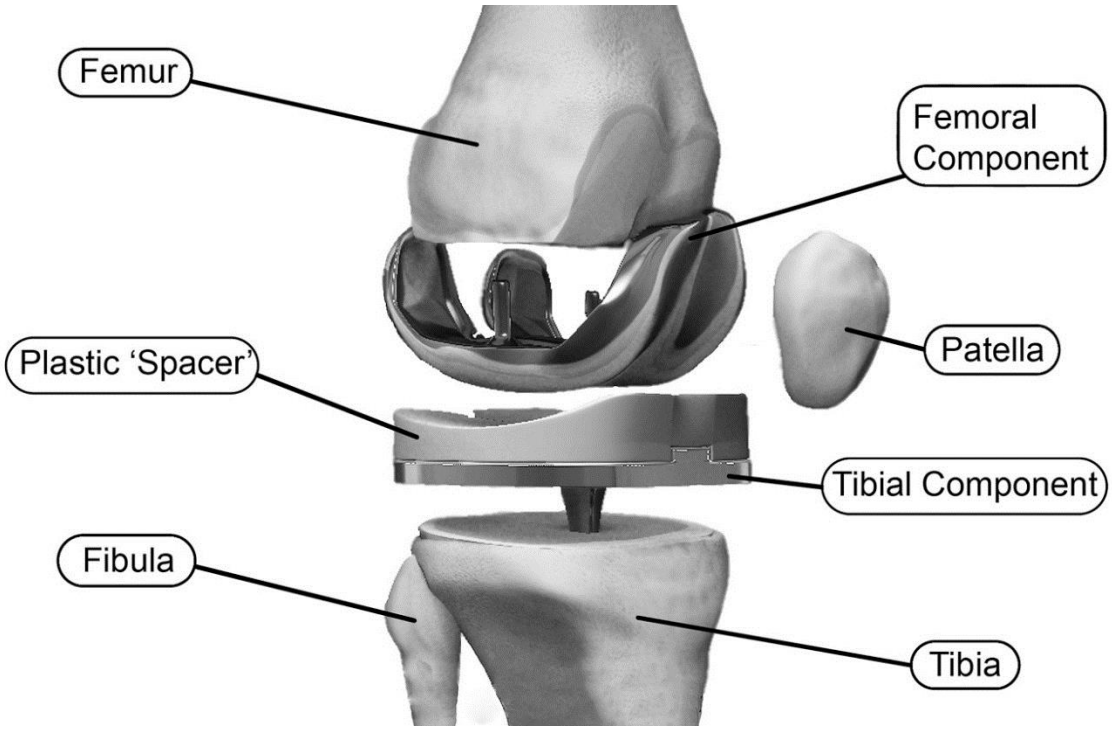
• severe form of diabetes • developed rheumatic fever (damage to periarticular soft tissues) • diseases associated with the minimization of blood • cardio-pulmonary insufficiency • renal failure • malignancy • tuberculosis • neuropsychiatric disease (Scuderi et al., 2002).

Knee arthroplasty is the optimal method of treatment in cases of inflammatory diseases of the knee (arthritis) and after injury of degenerative nature (arthrosis), when corruption and the gradual destruction of cartilage occurs. Total knee replacement eliminates pain, normalizes joint function, eliminates strain in the knee. With severe impairment, a full knee replacement is assigned.

Knee arthroplasty is a reconstructive surgical intervention consisting in the substitution of the modified surfaces of the femur and tibia (in some cases, the patella) to artificial to reduce the intensity of pain, restore mobility in the knee joint and the supporting ability of the lower limb (Scuderi et al., 2002).

The benefits of knee replacement surgery over other types of surgical treatment are: quick activation of patients, early load on the operated limb and restore of joint

movement, as well as the positive predictable results (Scuderi et al., 2002).



Picture 9. Mechanical joint implants (Roxytone, 2016).

The duration of the functioning of the modern models of the knee joint is 95-98% after 10 years, more than 90-95% in 15 years and 85-90% in 20 years after surgery (MacKenzie et al., 2014).

Unfortunately, many patients with diseases of knee joints unnecessarily long abstain from this type of treatment because of the fear of surgery and lack of awareness. They have to endure the pain daily, limit their active life, experience emotional suffering. Surgery to replace the artificial joint is a real opportunity to regain lost function of the limb and to stop feeling constant pain in the joint.

Knee arthroplasty is performed under spinal and general (endotracheal) anesthesia. Optimal and tolerable is spinal anesthesia. It is used in somatically healthy patients and patients with minor comorbidities. If there are contraindications to spinal anesthesia, most often in patients suffering from severe concomitant diseases, General anesthesia (endotracheal) is applied, during which the patient is asleep until the end. Modern medicinal drugs used in anesthesia, allow to minimize the risk of complications and to alleviate the discomfort during surgery and recovery from anesthesia (MacKenzie et al., 2014).

3.1. Preparation for surgery

What benefits can bring endoprosthesis replacement surgery? The artificial knee joint is not an exact replacement for a healthy joint. The fundamental positive aspect of the surgery is to get rid of pain for at least 10-12 years. 90% of patients with stiffness in the knee, get a significantly increased range of motion after arthroplasty. With artificial joint, the patient can perform many functions that he could do in previous years before the onset of the disease. Many patients return to sports and physical labor. However, after the implantation, certain loads should be avoided (Leopold, 2012).

3.2. How long is the implant going to last?

In 85 - 90% of patients, the knee joint is functioning normally within 10-12 years. In future, there is a possibility of loosening of the implant due to a gradual destruction of bone cement or by bone resorption. In 10 years, 25% of patients show signs of prosthesis loosening, 10 % of patients experience pain that requires revision surgery. After 10 years, 20% of patients need to perform the replacing the artificial joint (Leopold, 2012).

3.3. Before surgery

During the consultation, the doctor will determine the indications and contraindications for arthroplasty of the joint, will conduct the necessary research and proper selection of prosthesis. X-ray examination will help to determine the degree of deterioration of the knee joint, to make the necessary measurements.

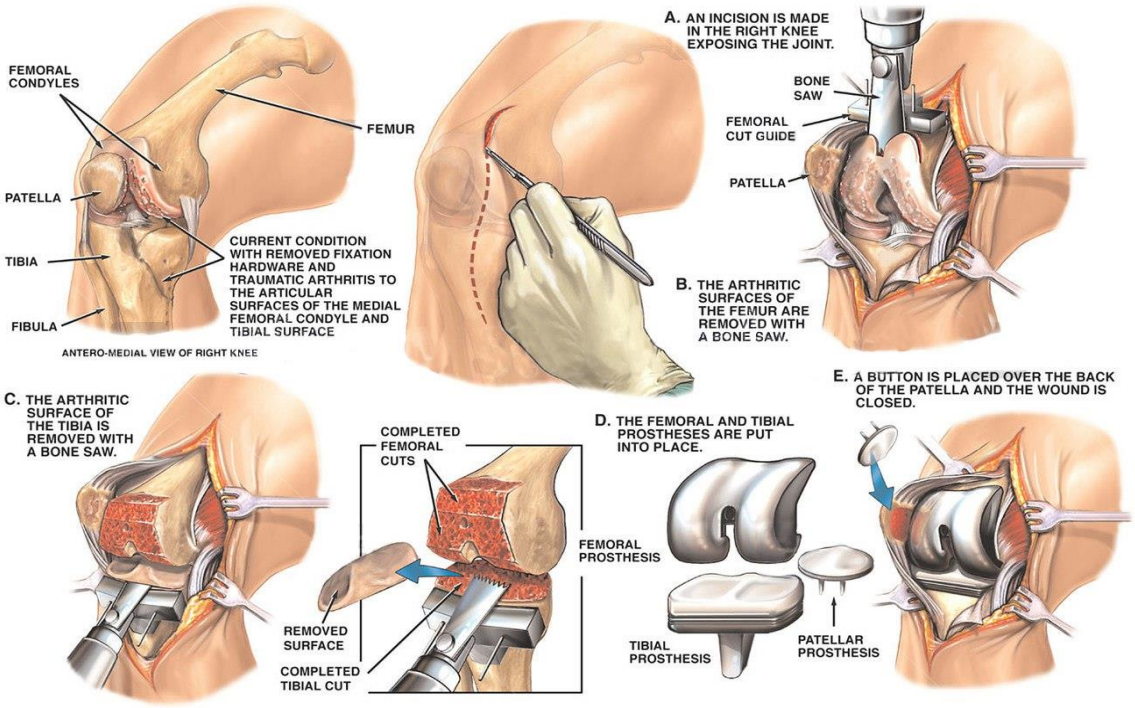
Knee surgery is a quite invasive surgery, which can cause blood loss. In many cases, blood transfusion is required during surgery or in the immediate postoperative period. Currently, the best way is blood transfusions of the patient's own blood, harvested for a few days before surgery. This technique, eliminates the risk of infection with hepatitis viruses B, C, HIV and some other infections. Another advantage of this method is reducing the risk of transfusion reactions. Typically, the taking of autologous blood of the patient is carried out 3-4 days before surgery in the outpatient setting in a volume of 450 ml (Leopold, 2012).

The night before the surgery, the cleansing enema is put, and the surgical field is necessarily shaved. To prevent the development of venous thrombosis of the lower limbs, drugs of heparin are subcutaneously administered to the abdomen. Morning before surgery excludes the intake of food and liquids. If the surgery is scheduled for the second half of the day, it is possible to take 1 cup of clear liquids in the morning (Leopold, 2012).

3.4. Operation

The knee joint replacement is one of the main achievements of this century in the field of orthopedics. Improving of operation equipment and materials used has led to huge successes in the treatment of osteoarthritis of the knee joint, the appearance of materials, which can replace the worn out joint with an artificial one. In the same way as a normal knee joint, artificial in exactly repeats the elements of a normal joint, allowing the necessary range of motion. Implantation of an artificial knee joint does not require extensive resection of bone during surgery and own ligamentous apparatus of the knee joint is maintained, except when it is damaged and requires restoration (Leopold, 2012).

3.5. Description of operations



Picture 10. Steps of the surgery (Mandir, 2016).

The procedure takes from 1.5 to 2.5 hours or more and is determined by the degree of pathological changes of the knee joint.

The knee is opened with a long slit, exposing the patella. Kneecap is shifted, opening a knee joint that is located behind it between the tibia and the femur. All the bony growths are removed, and the tension of the soft tissues is weakened, so the knee is returned to his natural form. Damaged sections of bone are cut. This is done with great precision so that precise components of an artificial joint (prosthesis) could close the worn out cartilage. The lower end of the femur is replaced with a single, steel anatomically adapted prosthesis. A flat plate of steel or titanium replaces the upper part of the tibia. Plate, attached to the plastic liners, allows the bones to move easily. Plastic liners are made from polyethylene so they are durable and smooth. With the combination of metal and plastic, joint has a low coefficient of friction (Hanssen et al., 2009).

When the bone is measured and prepared, the layout of the prosthesis is put and the joint is tested for stability and correctness of movements. Then it finally adjusted, the ends of the bones are cleared and the denture is already set into place, locking with a

special bone cement or using “press-fit” cementless fixation. The wound is then sutured and bandaged. A splint may be imposed so that the leg remains motionless.

After operation, antibiotics may be prescribed for some time to prevent infection, and painkillers are given.

If only one side of the knee is affected, partial knee replacement (unicompartmental knee replacement) is done. This is a gentler procedure than a complete replacement of the joint and it has a faster recovery period.

However, there is a high probability that in the future, after this procedure, another surgery will be required, which rarely happens after full replacement of the joint. This means that the surgery of joint replacement is less suitable for young active people and is best suited for older, thin people who lead a less active lifestyle (Hanssen et al., 2009).

Joint replacement is a major surgery and like any surgery, there is a number of risks. Operating risks of knee joint replacement are:

• wound infection - this is usually treated with antibiotics, rarely the wound is deeply affected, and may require additional surgery, more rarely, may require complete removal of the knee joint,

• a fracture or crack bone around the artificial joint during the operation or after – treatment, depends on the location and size of the crack or fracture, excessive bone formation around the implant, which limits the movement of the joint - requires additional surgery to remove excess bone and restore joint mobility,

• formation of excessive scar tissue, and as a result, limited mobility of the knee joint surgery to remove excess tissue, and reduced mobility of the joint,

• dislocation of the patella. - restore to normal position is possible by surgery

• numbness, numbness around scar,

• unexpected bleeding in the joint, damage to the ligaments, arteries or nerves around the knee joint (Hirschmann et al., 2015).

In some cases, the knee joint may remain unstable, and will require additional surgery for its correction. For six weeks or more after surgery, blood clots (thrombosis)

can form in the leg veins, causing pain and swelling. Blood thinning drugs help to get rid of the clot, and usually they do not deliver problems, but about one person out of twenty has pain and swelling. Very rarely, a clot can reach the lung and block a blood vessel (pulmonary embolism), this requires immediate medical care.

3.6. Non-surgical methods of treatment

Acupuncture in the treatment of arthritis

Arthritis affects about 46 million of Americans, representing more than one-fifth of the population. Most of these people were diagnosed with osteoarthritis, rheumatoid arthritis, gout. While these painful conditions are difficult to cure, there is the ability to naturally mitigate the symptoms by using acupuncture (Hirschmann et al., 2015).

Chapter 4: Rehabilitation after surgery

When the operation is performed, the patient is moved to a recovery room where he will spend two or three hours before he will be transferred to the permanent court, where the patient will be able to see relatives and friends. If possible, only a minimum circle of close friends should visit the patient, as staying of a large number of strangers in the surgical department can be harmful from the point of view of infection safety. In addition, the clinic is treating other people, which may prevent an overly large delegation of relatives and friends.

Depending on the type of anesthesia, general health and other factors, the patient can first be transferred to the ICU or postoperative ward for a longer time. The surgeon or anesthesiologist will discuss this before surgery. A team of staff providing care, will monitor the patient's condition, regardless of its location in the hospital, ensuring the effective and safe recovery. The patient’s body temperature will be periodically measured, to check the performance of the vital functions, as well as blood pressure. Stuff will change bandages, covering the area of the wound. The surgeon may decide about the

transfusion of blood, drugs that prevent forming of blood clots. In addition, within 2-3 days after surgery, antibiotics will be injected (Grass,2005).

4.1. Anesthesia

Many patients fear postoperative pain, and this is understandable. Pain control is currently a very complex process. Usually, the level of discomfort is easily controlled with medication in the form of tablets or injections.

In some cases, intravenous or epidural catheter is installed. For several days it allows to enter analgesics on demand (system of IV-PCA type, intravenous patient-controlled analgesia). The patient just needs to click a button and a new secure portion of the effective pain medication will flow through the body. Epidural (spinal) catheter injects painkillers automatically (Grass,2005).

4.2. The scar care

Usually, the sutures or the wound edges are held together by special brackets. 12-14 days after surgery, the sutures will be removed. Sometimes, the scar is sutured by absorbable threads, so there is no need to remove them.

Until the stitches are not removed, the patient once a day (and in normal healing, once in two or three days) needs to remove the sticker from the scars and wipe the seam clean with a cloth moistened with physiological solution. While the patient will be in a clinic, physician and nurses will take care of bandaging. After discharge, the scar should be kept clean and dry. In the first few months after surgery, the operated leg will swell - this is normal and there is nothing to be afraid of (Brugioni et al., 2004).

4.3. The resumption of daily activity

The majority of patients after endoprosthetic replacement note a startling decrease in knee pain and a significant increase in the ability to participate in everyday life. However, the patient needs to be prepared that recovery will take time. Probably

within a few weeks, the patient will be tired more than usual. Such surgery is a significant event.

After discharging home, he will need to track not only the status of new knee joint, but the overall condition within a few weeks. Especially, he should pay attention to the following:

- The temperature of the body. He needs to measure it twice a day and notify the doctor if it rises above 38,0°C.
- Not to forget to take prescribed medication in accordance with prescriptions of doctors.
- Immediately inform doctor, if there is pain, redness in the lower leg area, pain in the chest and/or shortness of breath. All these are possible signs of thrombus formation (Brugioni et al., 2004).

It is important to avoid getting of bacteria into the blood stream, as they can settle on the artificial joint and cause inflammation. The patient has to take antibiotics every time as there is a risk of bacterial infection, such as during dental treatment. It is a must to tell the dentist that there is an implant. Dentists know that in this case, they must prescribe an antibiotic before tooth extraction, surgery on the teeth surrounding tissues, dental implants, or work on root canals. It is advisable to take care of the teeth before surgery, or if it is not possible, revert to this question is not less than a year after the surgery (Brugioni et al., 2004).

4.4. Diet

By the time of return home from the hospital, the patient should eat normally. Doctor may recommend taking iron or vitamins. The patient should continue to drink plenty of fluids.

4.5. General guidelines for rehabilitation after arthroplasty:

• First 2 weeks – partial load with crutches, then - a gradual transition to full load and free mobility, if there is no swelling (appointed after consultation with the surgeon).

• Rotation effort under load must be excludes - reversal, changing the direction of movement based on the leg and stuff (except dropping to knees).

• The patient should stand up and sit down, putting the leg forward to avoid uncontrolled loads and forced movements.

Knee arthroplasty rehabilitation:

1^{st} – 2^{nd} days of rehabilitation.

Appointments for physiotherapy:

• Hardware massage to drain excess fluid from the body (lymphatic drainage)

• Active-assistive mobilization of the knee joint to the pain threshold

• Activities to mobilize out of bed, walking with crutches

• Cold therapy - cryotherapy

• Appointment of electrotherapy (except for direct currents)

• Active flexion and extension of the upper ankle joint to activate the muscle pump through (thrombosis prophylaxis)

3^{rd} – 6^{th} days of rehabilitation.

Physiotherapy:

• Hardware massage to drain excess fluid from the body (lymphatic drainage)

• Active-assistive mobilization of the joint to the threshold of pain, mobilization of the kneecap

• Motion bandage (kinesiotherapy)

• Exercise on control of gait

• Active-assistive mobilization of the adjacent joints (especially the top of the ankle and hip joints)

• Stress isometric extensor and flexor muscles of the thigh (isometric contraction)

• Cold therapy - cryotherapy

• Appointment of electrotherapy (except for direct currents)

• Motorization in the sitting position (medical ball, swing)

2^{nd} – 6^{th} weeks of rehabilitation.

Physiotherapy:

• The transition to full load, the control of gait

• Hardware massage to drain excess fluid from the body (lymphatic drainage)

• Exercises to mobilize the knee joint

• Exercises to mobilize the patella

• Manual de-toning of muscle seals and components, especially in the quadriceps and biceps muscles of the thigh, the triceps surae

• Proprioceptive neuromuscular relaxation (PNF)

• Motion bandage (kinesiotherapy)

• Active-assistive mobilization of the adjacent joints (especially the top of the ankle and hip joints)

• Stress isometric extensor and flexor muscles of the thigh (isometric contraction)

• Cold therapy - cryotherapy

• Appointment of electrotherapy (except for direct currents)

• Motorization in the sitting position (medical ball, swing)

Training therapy:

• Walking - training with the use of anti-gravity trainer Alter-G (unloading)

• Increased activation of quadriceps strengthening as a base

• Coordinating the training, primarily of the axial leg workout with unloading of the operated leg

• Muscle training - upper ankle joint and the lumbar-hip region

• Basic endurance training, is carried out on the Ergometer with adjustable length pedals (attention! care should be taken to avoid overheating of the implant)

• Stabilization of the trunk (optional)

Starting from the 7th week.

Physiotherapy:

• Exercises to mobilize the knee joint to fully straighten, bend to the desired 120°

• Exercises to mobilize the patella

• Manual de-toning of muscle seals and components, especially in the quadriceps and biceps muscles of the thigh, as well as in the triceps surae

• Proprioceptive neuromuscular relaxation (PNF)

• Mobilization of surgical seam

• Active-assistive mobilization of the adjacent joints (especially the top of the ankle and hip joints)

• Stress isometric extensor and flexor muscles of the thigh (isometric contraction)

• Cold therapy - cryotherapy

• Appointment of electrotherapy (except for direct currents)

Training therapy:

• Training to achieve optimal coordination conditions

• Enhanced coordination of training (particularly improvement in the phase of the supporting leg)

• Training to achieve well-developed force capabilities

• Strength training in a "closed kinetic chain" (functional rectification or squats with a partial load)

• Later also training in "open kinetic chain" (in the absence of complications): straightening, bending at the knees, for example

• Workout possible with minimal shock loads.

Physical therapy for total knee replacement in early postoperative period (exercises should be performed at least 6-10 times a day)

• Perform flexion-extension in the ankle joint (start with 5, then gradually build up to 20 repetitions).

• Perform flexion-extension in the knee joint, until mild pain.

Perform isometric exercises in initial position lying on the back:

• a) Press the straight leg to the surface, hold for 3-5 seconds, then relax. Do 10-15 times.

• b) Slightly bend the leg at the knee joint, then push the heel for support, to stay in this state for 3-5 seconds. Next leg to relax. Perform 10-15 times.

• c) Put a hand on the outer surface of the thigh and put pressure on it, the hip should oppose the hand in an isometric mode (hold for 3-5 seconds). Repeat 10-15 times.

Learning to stand up from the bed:

• a) Patient should get down from the bed from the side of the operated joint, and the foot should not rotate inside

• b) after cement prosthesis, the load on the operated leg may be given in full (starting from 3 days after surgery), while uncemented prosthetics - the first load should not be more than 20 kg

• the total load on the joint may be given only after 3 months after surgery.

The tasks of late recovery period after knee replacement include:

• - strengthening the muscles of the lower limbs (both)

• - the development of ascent and descent the stairs

• - recovery correct walking stereotype.

Therapeutic gymnastics in the replacement knee joint in the late postoperative period

Exercises are performed in the initial position - lying on the back:

• Perform flexion-extension in the ankle joint. Repeat 8-10 times.

• Perform a circular motion foot. Perform 8-10 times.

• To perform alternating flexion-extension of legs at the knee and hip joints, the heel should stay on the floor. Repeat 8-10 times.

• Put cushion under the knee, then complete extension of leg at the knee joint. Repeat 6-8 times.

• Perform disposal of direct feet in the parties. Repeat 8-10 times.

• Lift the pelvis, leaning on his elbows, the back of the head and the heels straightened feet, to stay in this position for 3 seconds. Repeat 4-6 times.

• Lift the pelvis and lower back, while leaning on his elbows, and the feet bent in knees. Hold this position for 3 seconds. Repeat 4-6 times.

• The legs bend at the knees, then, resting feet on the floor, take the knees apart. Repeat 8-10 times.

The following exercises are performed in the initial position - lying on the stomach:

• Perform alternate lifting of straightened legs. Repeat 8-10 times.

• Perform alternating flexion-extension of legs at the knee joints. Perform 8-10 times.

• Perform a simulated crawling "on belly".

• Relying on socks, try to separate the knees from the floor and hold them in the air for 3-5 seconds.

Physical therapy for knee replacement (exercises should be performed 3-5 times a day)

Starting position - lying on the back:

• Strain the front group of the thigh muscles (hold in this position for 2 to 5 seconds), then relax. Repeat 4-6 times.

• Strain rear muscle groups of the thigh (to remain in this position for about 2-5 seconds), relax. Perform 4-6 times.

• Strain the gluteal muscle (hold this position for 2-5 seconds), then relax. Repeat 4-6 times.

• Raise the straight leg and slowly lower down. Repeat 6-8 times.

• Perform extension and flexion in the knee joint. Repeat 6-8 times.

• Perform abduction-adduction of the knee. Repeat 6-8 times.

Starting position - standing:

Working with elastic bandages. Apply bandages 3-5 cm above the ankle joint.

• Lift straight leg forward at an angle of 35-45 degrees, stay in this position for 5-6 seconds, then return to the starting position. Repeat 4-6 times.

• Perform max direct foot to an angle of 45 degrees to the side, stay in this position for 5 seconds, then return to the starting position. Repeat 4-6 times.

• Perform Mach of the straight leg at an angle of 45 degrees back, stay in this position for 5 seconds, then return to the starting position. Repeat 4-6 times.

How long should crutches be used after knee replacement?

Usually 6 weeks after surgery, it is possible to walk with full load on the operated limb. Until that time, the load on the leg when walking with crutches should be increased gradually. In any case, the patient should consult with doctor and follow all his recommendations (Brugioni et al., 2004).

Physiotherapy plays a huge role in the rehabilitation of patients after endoprosthesis replacement of joints, as there are advantages over other treatments. When using therapeutic physical factors

:

• the range of methods of therapeutic effects significantly expands;

• treatment time is reduced;

• there is no allergy and drug disease;

• the effect of most drugs is potentiated;

• no drug dependency;

• no side effects on other organs and tissues;

• there are soft painless therapeutic effects;

• non-invasive methods of therapeutic effects are applied;

• period of remission of chronic diseases is longer (Brugioni et al., 2004).

4.6. Main types of activity.

In general, it is a must to adhere to the following guidelines:

• Load weight: the load weight on the operated leg should always be discussed with surgeon and doctor of physical therapy. Their recommendations will depend on the type of prosthesis and other features of the case.

• Driving: the patient may begin to drive a car with automatic transmission in 4-8 weeks. If the patient has a car with a manual transmission, it may take more time. Physical therapist will show how to safely get in and out of the vehicle. A plastic bag put on the seat can ease the sliding and landing in the car.

• Sexual relations can be safely resumed four to six weeks after surgery.

• Body position during sleep: No any restrictions. The patient should sleep in any comfortable position.

• How to sit: in any comfortable pose.

• Return to work. The surgeon will determine when the patient is ready to return to work from a medical point of view. During the first control visit (usually four to six weeks after the operation) in the normal course of events, the surgeon may authorize the resumption of work full-time. If the work does not require considerable physical effort, the patient can return to it even earlier, at least partially (maybe a few hours once or twice a week).

• Other activity: walk as much as possible, if the doctor says it is okay, but walks are not a substitute for performing prescribed exercises.

Also swimming in the pool is very useful. The patient can start to swim when the surgeon decides that postoperative wound healed well. After three months, most patients can return to an active life, including bowling, cycling, dancing, playing tennis, and in some cases even skiing. Most surgeons do not recommend such excessively heavy loads as jogging and basketball. It is better not to lift heavy objects (over 18 kg) and forget about weightlifting. Every activity should be discussed with the doctor to be sure that it will not harm the patient (Brugioni et al., 2004).

4.7. Risk factors and possible complications

Knee replacement is a planned operation, which requires careful inspection, research of health of the patient. This largely eliminates the risk, but it is impossible to protect from them. Complications during the intervention can be due to the anatomical features of joints, general condition, and after the operation – a way of life, illnesses or injuries, neglecting strengthening exercises. During the surgery, heart failure, breathing problems, poor circulation in the brain because of a reaction to the anesthesia, damage to blood vessels, nerves, a fracture or crack bone, different length limbs may occur.

Complications at early surgery period: the divergence of the wound, inflammation; deep vein thrombosis, formation of blood clots; patellar luxation or

components of the prosthesis; allergic reactions to anesthesia, medications; acute respiratory failure, cardio-vascular system.

To avoid them, the patient needs to follow all the recommendations of doctors, try not to create a traumatic situation and be sure to do test samples for new medicines. Late complications after endoprosthetic replacement can manifest itself in the form of: displacement of the prosthesis (also referred to as technical slacking); temporary crunch when moving the patella, which should pass during the rehabilitation; contracture of joint, when limited to its mobility during flexion or extension; the formation of excess scar tissue near the implant, fracture of the bone in the area (Brugioni et al., 2004).

The rupture of a blood vessel or nerve. During the surgery, there is a very low possibility of damaging blood vessels and nerves. If after the operation, the patient suddenly feels weakness or numbness, he should immediately inform the doctor (Fagerson, 1998).

5. Special Part (Case Study)

5.1. Methodology

I had the clinical work with the patient, took place at CLPA Clinic in Prague. Physiotherapy program started on Monday 19.1.2016 and ended on Friday 29.1.2016. For 10 days 8 hours daily with total amount 80 hours of practicing.

The clinical practice was supervised by PhDr. Edwin Maher ,PHD. Number of therapy sessions I had with patient 6 times.

The therapy procedures were applied in exercise room, most of therapies were manually, I used instruments and tools, soft ball for soft tissue techniques and decrease swelling, overball for ROM and strengthening exercises, record for ROM and strengthening exercises.

For examination I used goniometer for ROM examination, measurement tape for length and circumference of lower extremities.

Patient was walking without crutches, while I did the posture examination patient was standing without crutches near to treatment table.

The work has been approved by the Ethics Committee of Faculty of Physical Education and Sport Chareles University.

5.2. Anamnesis

5.2.1. Personal anamnesis

Age: 1944

Examined person: M.B **Male** **Code: M171**

Diagnosis: After total left knee Replacement.

Subjective feeling of the patient: Patient is in two months after Total left knee replacement, complains of restricted range of motion in knee joint in flexion direction, pain on the lateral part of thigh, a slight swelling of the left knee, the patient pain in general scale is 3-5/10, he has full sensation in both legs and the scar is about 7cm.

Cause of Problem: Three months got injury during hard work in home, he felt unusual pain on his left leg then he went to the doctor to check up then doctor did knee arthroscopic for him and got operated in 3.12.2015 and from long time ago he had ACL ruptured during football match in the left leg.

Allergies: None

Abuses: None alcohol drinker, none smoker**.**

Hobbies: General sports games.

Occupation: Retired, he used to work as External teacher of football at Charles university.

5.2.2. History of Problem: Three months got injury during hard work in home, he felt pain on his left leg then he went to the doctor which did the knee arthroscopic for him and get operated in 3.12.2015
.

5.2.3. Medications: Clexane

Excerpt from patient's health care file: None

5.2.4. Social Anamnesis: He lives in house with two floors and stairs in Prague with his wife.

5.2.5. Family History: Healthy wife and children, his mother and father are dead.

5.2.6. Operations: Meniscus of left and right knee

Injuries: Meniscus of left and right knee.

5.2.7. Prior rehabilitation: Standard rehabilitation of previous injuries

5.2.8. RHB indications:

- Exercises for limited ROM of knee joint
- Soft tissue techniques for skin and fascia
- Stretching of shorted muscles
- Strengthening and stimulation of weak muscles of lower extremity
- Relaxing hypertonic muscles using PIR technique
- Mobilization for restricted joints of the lower extremity
- Sensomotoric training to improve proprioception level
- Correct posture and gait

5.2.9. Status presents:

Height: 186 cm Weight: 70 kg BMI: 24.8 Blood pressure: 114 over 76 Heart rate: 73

5.3. Initial Examinations

5.3.1. Aspection:

Patient in good health condition, he felt pain on the lateral part of the thigh, there was slight swelling on the left knee joint, the scar is about 7cm.

5.3.2. Postural examination (by Kendal):

Anterior view:

-Weight baring to the right side

-Slightly eversion of the right foot.

-Both knee in external rotation

-Swollen of left knee

- Both upper extremities are in slightly internal rotation

- Right shoulder is higher than the left shoulder

-Angle space of the right hand is wider the left hand

Lateral view:

- Slightly semi flexed of the left knee joint

- Normal curves of lumber and thoracic spine

- Protracted of both shoulder

-Hyperextension of the cervical spine

Posterior view:

- Weight baring to the right side

- Pelvis tilted to the right side

- Whole spine is in mid line

- Winging of the left scapula

- Both upper extremities are in slightly internal rotation

- Right shoulder is higher than the left shoulder

-Angle space of the right hand is wider the left hand

Pelvis examination (by Kendal):

The position of the pelvic was slightly anterior tilt and shifted to the right side.

5.3.3. Gait examination (by Kendal):

- Whole body limping to the right side
- He walks more on the lateral aspects of the foot
- There was more flexion of the knee on the right knee
- More loading on the left side
-Angle space of the right hand is wider the left hand during walking
-Winging of the left hand
-The rhythmic and length of steps was symmetrical

Modification of gait examination:

Walking on tip toes: Patient is able to do it but there is not full extension of his left knee joint.

Walking with squats: Patient isn't able to do it. because of the marked limitation of the left knee joint and pain.

5.3.4. Soft tissue examination (by Lewit):

- Skin and connective tissue of lower extremity (shin and calf) is restricted in both directions (medial and lateral) in the left leg.
- Deep facia of the thigh is restricted in both directions (medial and lateral) around the axis of the lower extremity in both legs.

5.3.5. Special tests:

2 Scales test: R 37 kg L 33 kg

Trandelburg's test: The patient was able to perform the test on right side but on the left side the patient was slightly shaking and the pelvic slightly drooped which represents weakness in the left hip abductors. So, the test was positive in the left side.

Romberg test:

I negative

II negative

III negative

5.3.6. Anthropometry examination (by Kendal):

Measurement	Right lower extremity	Left lower extremity
Anatomical length	83 cm	83 cm
Functional length	86 cm	86cm
Length of the thigh	43 cm	43 cm
Length of the middle leg	40 cm	40 cm
Length of the foot	22 cm	22 cm
Circumference of thigh Quadriceps	49 cm	48 cm
Vastus Medialis	45 cm	43 cm
Circumference of knee joint	40 cm	42 cm

Table No.1 - Anthropometric measurement for length and circumference of lower extremity [cm]

Conclusion of findings from anthropometric examination includes sign of edema with increased circumference around the knee joint.

5.3.7. Palpation examination (by Kendal):

Muscle	Position	Left side	Right side
M. Quadriceps (m. rectus femoris)	Supine	Hypotonic	Normal tonus
M. Tensor fasciae latae	Supine	Hypertonic	Hypertonic
M. Adductors (m. adductor longus, magnus, brevis)	Supine	Normal tonus	Normal tonus
M. Hamstrings	Prone	Hypotonic	Normal tonus
M. Iliopsoas	Supine	Hypertonic	Hypertonic
M. Gastrocnemius	Prone	Normal tonus	Normal tonus
M. Gluteus maximus	Prone	Normal tonus	Normal tonus
M. Piriformis	Prone	Normal tonus	Normal tonus

Table No.2 - Examination of muscle tone by Lewit

5.3.8. Range of motion examination (by Kendal):

Ankle				
Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Plantar flexion	50 ^{o}	52 ^{o}	57 ^{o}	58 ^{o}
Dorsi flexion	19 ^{o}	20 ^{o}	24 ^{o}	25 ^{o}
Foot inversion	13 ^{o}	15 ^{o}	20 ^{o}	23 ^{o}
Foot eversion	10 ^{o}	10 ^{o}	15 ^{o}	15 ^{o}

Table No.3 - Range of motion examination of ankle by Kendal

Hip				
Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion	100 ^{o}	110 ^{o}	115 ^{o}	120 ^{o}
Extension	10 ^{o}	10 ^{o}	15 ^{o}	15 ^{o}
Adduction	23 ^{o}	25	27 ^{o}	30 ^{o}
Abduction	40 ^{o}	45 ^{o}	55 ^{o}	57 ^{o}
External Rotation	-	40 ^{o}	-	45 ^{o}
Internal Rotation	-	40 ^{o}	-	45 ^{o}

Table No.4 - Range of motion examination of hip by Kendal

Knee				
Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion	40 ^{o}	130 ^{o}	47 ^{o}	143 ^{o}
Extension	0 ^{o}	-15 ^{o}	0 ^{o}	-10 ^{o}

Table No.5 - Range of motion examination of knee by Kendal

Rotations in hip on left side were not done by goniometer (due to patient condition) while he couldn't do knee flexion until 90 degrees. So, we do it evaluational by semiflexed left knee, while patient is supine.

5.3.9. Muscle strength examination (by Kendal):

Muscle	Right lower extremity	Left lower extremity
M. Quadriceps femoris	5	4-

M. Hamstrings	5	4-
M. Adductors	5	4+
M. Tensor fasciae latae	5	4-
M. Gastrocnemius	5	4
M. Iliopsoas	5	4+
M. Gluteus maximus	4	4
M. Gluteuse medius	4	4-

Table No.6 - Muscle strength examination by Kendal

5.3.10. Muscle length examination (by Janda):

Muscle	Right lower extremity	Left lower extremity
M. Quadriceps femoris	0	2
M. Hamstrings	1	1
M. Adductors	0	0
M. Tensor fasciae latae	0	1
M. Gastrocnemius	0	0

Table No.7 - Muscle length examination by Janda

5.3.11. Neurological examination (by Lewit):

Deep sensation test: Position sense: it was examined of both lower extremities it was negative in all joints. Sterognosis: he was able to recognise the objects by both hands and feet. Both are negative. Graphesthesia: he was able to recognise what was written on both hands and both lower extremities. Both are Negative.

Babinski reflex was also negative/without pathological findings.

Rhomberg test: I, II, III are Negative

Superficial sensation test: light touch: it was examined on both lower extremities on the inner and outer aspects. The test is Negative

Examination of deep tendon reflexes (by Lewit):

After having completed a standard testing of reflexes however, the reflex of the left and right lower extremity were normal 2 reflex of Patellar tendon and normal 2 reflex of Achilles tendon as well as the Plantar 2 reflexes showed physiological and symmetrical response.

5.3.12. Joint Play Examination (by Lewit):

Joint	**Left side**	**Right side**
Sacroiliac	Restricted in upper and lower part	Restricted in upper and lower part
Patella	Restricted in the cranial, lateral and medial directions	No restriction in all directions
Head of fibula	Restricted in ventral and dorsal directions	No restriction in all directions
Talocrural	No restriction	No restriction
Subtalar	No restriction	No restriction
Chopar't	No restriction	No restriction
Lisfranc's	No restriction	No restriction
Metatarsophalangeal	No restriction in all directions	No restriction in all directions
Interphalangeal	No restriction in all directions	No restriction in all directions

Table No.8 - Joint play examination by Lewit

5.3.13. Examinations conclusion:

Patient is feeling a pain in left knee sometimes during day or when changing position and after exercising. Patient has faulty posture of standing with more loading on the right side, swelling of left knee with outward rotation of both knee and slightly eversion of the right foot, both upper extremities are in internal rotation, right shoulder is higher than the left shoulder, slightly semi flexed of the left knee joint, Protracted of both shoulder, hyperextension of the cervical spine. From gait the patient is limping his trunk to the right side, he walks more on the lateral aspects of the foot, there was more flexion of the knee on the right knee, more loading on the left side, angle space of the right hand is wider the left hand during walking with winging of the left hand and the rhythmic and length of steps was symmetrical. Patient was not able to walk with squat due to the marked limitation of his left knee joint and pain while he was able to walk on tip toes but without full extension of left knee. From Soft tissue examination, it was restricted the skin and connective tissue of the left leg in both directions (medial and lateral), deep facia of the thigh is restricted in both directions (medial and lateral) around the axis of the lower extremity in both legs. Trandelburg's test was positive in the left side patient couldn't maintain the pelvis balance which represents weakness in the left hip abductors. Conclusion of findings from anthropometric examination there was increased circumference around the left knee joint. From Palpation examination, generally the patient had hypertone of the hip flexors of both lower extremity and both M. Tensor fasciae latae. Most hypotone was found along left M. Quadriceps (m. rectus femoris), left M. Hamstrings in comparison, the right side presents a quite physiological/optimal muscle tonus**.** Conclusion of findings in range of motion includes a significant decrease in ROM of left knee joint. The patient experiences pain in passive movement at the end of the ROM of the knee joint. Movement of knee to flexion is the worst. Conclusion of findings from muscles strength testing: Generally weaker on left lower extremity in comparison with right side. Conclusion of muscles length testing: Marked shortness found on left lower extremity of quadriceps. Mild shortness was found on both extremities in tensor fasciae latae and hamstrings. From Neurological examination, deep and Superficial sensation test was negative. Examination of deep tendon reflexes was normal reflexes and showed physiological and symmetrical response. By assessing joint play of lower

extremity in all directions according Lewit, Sacroiliac joint was restricted in all direction, the left patella was found with hard movement restrictions in the cranial, lateral and medial direction, Head of fibula Restricted in ventral and dorsal directions.

5.4. Short-term and long-term rehabilitation plans

5.4.1. Short-term plan:

- Reduce pain (applying hot rolls and PIR)

-Reduce swelling

- Relax hyper tonic muscles (using PIR technique)

- Increase ROM in limited joints (using passive and active ROM training)

- Stretch shorted muscles (using PIR with stretching and stretching techniques)

- Mobilization for restricted joints

- Activation of hypotonic muscles

- Strengthening of weak muscles

- Correct faulty gait with instructions

5.4.2. Long-term plan:

- Keep strengthening exercises for weak muscles

- Improve stability of the knee

- Stretching exercises for shortened muscles

- Relaxing hypertonic muscles

- Activities of daily living training

- Improve gait pattern

- Advices to improve posture daily activities

Physical therapy tools:

- Kinesio-tape for decreasing the swelling and improving stability

5.5. Day to day therapy

Date 19.1.2016

Goal of today's therapy unit

The goal of therapy is to increase range of motion of the left knee joint. Activation of hypotonic muscles on left leg (M. quadrates femoris). Soft tissue techniques for the scar and for left shin and calf, left foot (dorsum) deep fascia of thigh. Mobilization of patella and head of fibula joints. PIR techniques for hypertonic muscles. Strengthening of left knee extensors and flexors and hip joint abductors.

Procedure

For increase ROM of knee joints

Patient in supine and using small ball under heel with asking the ptient to move his heel in direction of flexion of knee and hip.

Scare care By Lewit, using connective tissue fold, by pressing scar tissue with fingers forming a C and S shapes and wiat for release of the scar.

Stretching connective tissues By Lewit, in left calf and shin, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

Stretching connective tissues By Lewit, in left thigh, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

For mobilization of patella and head of fibula joints.

Patient lying on bed supine with legs extended, we perform the mobilization of the left patella which is restricted in the cranial, lateral and medial direction by using therapist fingers to move patella to the restriction direction and hold it until release.

For mobilization of head of fibula joints, patient is supine with slightly flexed knee, with the thump and fingers moving the head of fibula to restricted ventral and dorsal direction till reaching the barrier and then wait for release.

For Activation of hypotonic muscles on left leg

Isometric contraction of quadriceps muscles while patient is supine, and we place a small ball under the left knee and ask the patient to push the ball against table and hold it for a short time then relax.

PIR techniques for hypertonic muscles according to lewit M. Tensor fasciae latae, M. Hamstrings, M. Iliopsoas and M. Quadriceps (m. rectus femoris)

For strengthening knee extensors muscles

By using theraband, where the patient is prone, attach elastic to ankle grapping the other end of elastic with hand of patient near shoulder, begin with knee bent, extend knee against pull of band and Slowly return to start position and repeat.

For strengthening knee flexor muscles

By using theraband where the patent is Prone, attach elastic to secure object. and attach elastic to ankle of involved leg begin with knee straight. Bend knee through available range slowly return to starting position.

For strengthening hip Abductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level. then Stand with the non-involved leg beside the secure object, keep knee straight, pull away, moving leg in the dirction of abduction then slowly return to start position.

For strengthening hip Adductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level, stand with involved leg beside the secure object, keep knee straight, pull in moving leg to the dirction of adduction then slowly return to start position.

At the gym

The patient walked on unstable surfaces, with grapping a small ball then pass it around the body

The patient was standing on bosu, with graping a small ball and throw it from hand to hand

All exercises were done 3 times 10 repetitions

At the end of exercising in the gym patient went for cycling for 10 min.

Results

Patient was feeling good, he used to do similar exercises that learned from my supervisor, he has good stability and good condition strength of lower extremities muscles.

Self-therapy

We instruct the patient to perform some active movement exercises at home to have more range of motion especially for knee flexion. as well as isometric contraction knee muscles extensors, instruct him to exercise with the therabnd at home as he did in the gym.

Date 20.1.2016

Goal of today's therapy unit

Improve ROM of knee, mobilisation of sacroiliac, left patella and head of fibula joints, stretching of knee flexor and extensor muscles, mobilization of deep fascia of thighs, lymph drainage, gait training, strengthening exercises of weak muscles, relaxation of hypertonic muscles and soft tissues.

Procedure

For increase ROM of knee joints

Patient in supine and using small ball under heel with asking the ptient to move his heel in direction of flexion of knee and hip.

Scare care By Lewit, using connective tissue fold, by pressing scar tissue with fingers forming a C and S shapes and wiat for release of the scar.

Stretching connective tissues By Lewit, in left calf and shin, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release

while patient is supine with semi flexed left knee.

Stretching connective tissues By Lewit, in left thigh, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

For mobilization of patella and head of fibula joints.

Patient lying on bed supine with legs extended, we perform the mobilization of the left patella which is restricted in the cranial, lateral and medial direction by using therapist fingers to move patella to the restriction direction and hold it until release.

For mobilization of head of fibula joints, patient is supine with slightly flexed knee, with the thump and fingers moving the head of fibula to restricted ventral and dorsal direction till reaching the barrier and then wait for release.

For mobilization of upper part of the sacroiliac joint, patient is lying on side not being treated with flexed knee, with one hand therapist exerts light springing pressure against ASIS in caudal direction with the other hand apply counterpressre below the PSIS then slack has been taking we performed rhythmic springing against ASIS till we feel it release.

For mobilization of lower part of the sacroiliac joint, patient is lying on side not being treated with flexed knee, with one hand therapist grasp the ASIS and with the ulnar aspect of the other hand takes up the lateral contact with dorsal end of sacrum, for mobilisation using rotating sacrum in related to ileum convergent movement of both hands and forearm after the slack has been taking we performed rhythmic movement till we feel it release.

For gait training

We asked the patient to walk forward slowly and with semi flexed knees, contact with three points of heel, sole and tiptoes

We asked the patient to walk Backward slowly with contact of three point of toes, sole and heels

We asked the patient to walk Side to side slowly with contact of three point of toes, sole and heels

We asked the patient to walk with tiptoes and contact on tiptoes

We asked the patient to walk with heel and contact on heel

PIR techniques for hypertonic muscles according to lewit M. Tensor fasciae latae, M. Hamstrings, M. Iliopsoas and M. Quadriceps (m. rectus femoris)

For strengthening exersise

Standing on bosu, patient is standing with semi flexed knees, hips and slight external rotation of hip and throw a small ball from hand to the other hand.

For strengthening knee extensors muscles

By using theraband, where the patient is prone, attach elastic to ankle grapping the other end of elastic with hand of patient near shoulder, begin with knee bent, extend knee against pull of band and Slowly return to start position and repeat.

For strengthening knee flexor muscles

By using theraband where the patent is Prone, attach elastic to secure object. and attach elastic to ankle of involved leg begin with knee straight. Bend knee through available range slowly return to starting position.

For strengthening hip Abductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level. then Stand with the non-involved leg beside the secure object, keep knee straight, pull away, moving leg in the dirction of abduction then slowly return to start position.

For strengthening hip Adductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level, stand with involved leg beside the secure object, keep knee straight, pull in moving leg to the dirction of adduction then slowly return to start position.

Knee and hip extensors, bridging

Patient supine with flexed knee and arms at side raise pelvis off. Hold this position for a few seconds, then return the foot to the floor

For lymph drainage, after exercising

We apply lymph drainage massage in the lower extremety with moderate pressre starting from caudal to cranial dirction.

Stretching exercises for quadriceps and hamstring

For quadriceps, patient is lying prone and loop the strap around the foot holding the ends

of the strap with both hands. puling his heel up toward the ceiling. Hold this stretch for 20 to 30 seconds then Relax

For hamstring, patient is lying supine and loop the strap around the foot holding the ends of the strap with both hands. chin down and shoulders back. pushing his heel up toward the ceiling. Hold this stretch for 20 to 30 seconds then Relax

All exercises were done 3 times 10 repetitions

At the end of exercising in the gym patient went for cycling for 10 min.

Results

Patient feels progress with slight due to the effort that he done pain, we notice that he has more range of motion of knee joint than the previous visit, joint play was improved so the mobility of the knee joint was good, the strength of muscles was better.

Self-therapy

Patient can perform the stretching of hamstring and quadriceps by using belt at home to increase the length and can perform the strengthening of the weak muscles by using theraband as he learned

Date 21.1.2016

Goal of today's therapy unit

Improve ROM of knee, mobilisation of sacroiliac, left patella and head of fibula joints, stretching of knee flexor and extensor muscles, mobilization of deep fascia of thighs, lymph drainage, gait training, strengthening exercises of weak muscles, relaxation of hypertonic muscles and soft tissues.

Procedure

For increase ROM of knee joints

Patient in supine and using small ball under heel with asking the ptient to move his heel in direction of flexion of knee and hip.

Stretching connective tissues By Lewit, in left calf and shin, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

Stretching connective tissues By Lewit, in left thigh, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

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Patient lying on bed supine with legs extended, we perform the mobilization of the left patella which is restricted in the cranial, lateral and medial direction by using therapist fingers to move patella to the restriction direction and hold it until release.

For mobilization of head of fibula joints, patient is supine with slightly flexed knee, with the thump and fingers moving the head of fibula to restricted ventral and dorsal direction till reaching the barrier and then wait for release.

For mobilization of upper part of the sacroiliac joint, patient is lying on side not being treated with both flexed knee one above the other, with one hand therapist exerts light springing pressure against ASIS in caudal direction with the other hand apply counterpressre below the PSIS then slack has been taking we performed rhythmic springing against ASIS untill we felt it release.

For mobilization of lower part of the sacroiliac joint, patient is lying on side not being treated with flexed knee, with one hand therapist grasp the ASIS and with the ulnar aspect of the other hand takes up the lateral contact with dorsal end of sacrum, for mobilisation using rotating sacrum in related to ileum convergent movement of both hands and forearm after the slack has been taking we performed rhythmic movement untill we felt it release.

For gait training

We asked the patient to walk forward slowly and with semi flexed knees, contact with three points of heel, sole and tiptoes

We ask the patient to walk Backward slowly with contact of three point of toes, sole and heels

We askd the patient to walk Side to side slowly with contact of three point of toes, sole

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PIR techniques for hypertonic muscles according to lewit M. Tensor fasciae latae, M. Hamstrings, M. Iliopsoas and M. Quadriceps (m. rectus femoris)

For strengthening exersise

Standing on bosu, patient is standing with semi flexed knees, hips and slight external rotation of hip and throw a small ball from hand to the other hand.

Knee and hip extensors, bridging

Patient supine with flexed knee and arms at side raise pelvis off. Hold this position for a few seconds, then return the foot to the floor

For strengthening knee extensors muscles

By using theraband, where the patient is prone, attach elastic to ankle grapping the other end of elastic with hand of patient near shoulder, begin with knee bent, extend knee against pull of band and Slowly return to start position and repeat.

For strengthening knee flexor muscles

By using theraband where the patent is Prone, attach elastic to secure object. and attach elastic to ankle of involved leg begin with knee straight. Bend knee through available range slowly return to starting position.

For strengthening hip Abductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level. then Stand with the non-involved leg beside the secure object, keep knee straight, pull away, moving leg in the dirction of abduction then slowly return to start position.

For strengthening hip Adductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level, stand with involved leg beside the secure object, keep knee straight, pull in moving leg to the dirction of adduction then slowly return to start position.

For lymph drainage, after exercising

We apply lymph drainage massage in the lower extremety with moderate pressre starting

from caudal to cranial dirction.

Stretching exercises for quadriceps and hamstring

For quadriceps, patient is lying prone and loop the strap around the foot holding the ends of the strap with both hands. puling his heel up toward the ceiling. Hold this stretch for 20 to 30 seconds then Relax

For hamstring, patient is lying supine and loop the strap around the foot holding the ends of the strap with both hands. chin down and shoulders back. pushing his heel up toward the ceiling. Hold this stretch for 20 to 30 seconds then Relax

Hydrotherapy, after exercising

Patient went for whirlpool Temperature 37 C to relax the muscles and soft tissues and anti-edema, duration 30 min.

All exercises were done 3 times 10 repetitions

At the end of exercising in the gym patient went for cycling for 10 min.

Results

Patient feels good almost no pain we notice that he is getting more range of motion of knee joint than the last session and joint play was improved so the mobility of the sacroiliac and knee joint was good, the strength of muscles is getting better.

Self-therapy

Patient can perform the stretching of hamstring and quadriceps by using belt at home to increase the length and can perform the strengthening of the weak muscles by using theraband as he learned

Date 25.1.2016

Goal of today's therapy unit

Improve ROM of knee, mobilisation of sacroiliac, left patella and head of fibula joints, stretching of knee flexor and extensor muscles, mobilization of deep fascia of thighs, lymph drainage, gait training, strengthening exercises of weak muscles, relaxation of

hypertonic muscles and soft tissues.

Procedure

For increase ROM of knee joints

Patient in supine and using small ball under heel with asking the ptient to move his heel in direction of flexion of knee and hip.

Stretching connective tissues By Lewit, in left calf and shin, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

Stretching connective tissues By Lewit, in left thigh, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

For mobilization of patella and head of fibula joints.

Patient lying on bed supine with legs extended, we perform the mobilization of the left patella which is restricted in the cranial, lateral and medial direction by using therapist fingers to move patella to the restriction direction and hold it until release.

For mobilization of head of fibula joints, patient is supine with slightly flexed knee, with the thump and fingers moving the head of fibula to restricted ventral and dorsal direction till reaching the barrier and then wait for release.

For mobilization of upper part of the sacroiliac joint, patient is lying on side not being treated with both flexed knee one above the other, with one hand therapist exerts light springing pressure against ASIS in caudal direction with the other hand apply counterpressre below the PSIS then slack has been taking we performed rhythmic springing against ASIS untill we felt it release.

For mobilization of lower part of the sacroiliac joint, patient is lying on side not being treated with flexed knee, with one hand therapist grasp the ASIS and with the ulnar aspect of the other hand takes up the lateral contact with dorsal end of sacrum, for mobilisation using rotating sacrum in related to ileum convergent movement of both hands and forearm after the slack has been taking we performed rhythmic movement untill we felt it release.

For gait training

We asked the patient to walk forward slowly and with semi flexed knees, contact with three points of heel, sole and tiptoes

We ask the patient to walk Backward slowly with contact of three point of toes, sole and heels

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PIR techniques for hypertonic muscles according to lewit M. Tensor fasciae latae, M. Hamstrings, M. Iliopsoas and M. Quadriceps (m. rectus femoris)

For strengthening exersise

Standing on bosu, patient is standing with semi flexed knees, hips and slight external rotation of hip and throw a small ball from hand to the other hand.

Knee and hip extensors, bridging

Patient supine with flexed knee and arms at side raise pelvis off. Hold this position for a few seconds, then return the foot to the floor

For strengthening knee extensors muscles

By using theraband, where the patient is prone, attach elastic to ankle grapping the other end of elastic with hand of patient near shoulder, begin with knee bent, extend knee against pull of band and Slowly return to start position and repeat.

For strengthening knee flexor muscles

By using theraband where the patient is Prone, attach elastic to secure object. and attach elastic to ankle of involved leg begin with knee straight. Bend knee through available range slowly return to starting position.

For strengthening hip Abductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level. then Stand with the non-involved leg beside the secure object, keep knee straight,

pull away, moving leg in the dirction of abduction then slowly return to start position.

For strengthening hip Adductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level, stand with involved leg beside the secure object, keep knee straight, pull in moving leg to the dirction of adduction then slowly return to start position.

For lymph drainage, after exercising

We apply lymph drainage massage in the lower extremety with moderate pressre starting from caudal to cranial dirction.

Stretching exercises for quadriceps and hamstring

For quadriceps, patient is lying prone and loop the strap around the foot holding the ends of the strap with both hands. puling his heel up toward the ceiling. Hold this stretch for 20 to 30 seconds then Relax

For hamstring, patient is lying supine and loop the strap around the foot holding the ends of the strap with both hands. chin down and shoulders back. pushing his heel up toward the ceiling. Hold this stretch for 20 to 30 seconds then Relax

Hydrotherapy, after exercising

Patient went for whirlpool Temperature 37 C to relax the muscles and soft tissues and anti-edema, duration 30 min.

All exercises were done 3 times 10 repetitions

At the end of exercising in the gym patient went for cycling for 10 min.

Results

Patient feels tired with no pain we notice that his range of motion of knee joint in progress and joint play improved so the mobility of the sacroiliac and knee joint was good, the strength of muscles was better.

Self-therapy

Patient can perform the stretching of hamstring and quadriceps by using belt at home to

increase the length and can perform the strengthening of the weak muscles by using theraband as he learned

Date 27.1.2016

Goal of today's therapy unit

Improve ROM of knee, mobilisation of sacroiliac, left patella and head of fibula joints, stretching of knee flexor and extensor muscles, mobilization of deep fascia of thighs, lymph drainage, gait training, strengthening exercises of weak muscles, relaxation of hypertonic muscles and soft tissues.

Procedure

For increase ROM of knee joints

Patient in supine and using small ball under heel with asking the ptient to move his heel in direction of flexion of knee and hip.

Stretching connective tissues By Lewit, in left calf and shin, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

Stretching connective tissues By Lewit, in left thigh, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

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For mobilization of upper part of the sacroiliac joint, patient is lying on side not being

treated with both flexed knee one above the other, with one hand therapist exerts light springing pressure against ASIS in caudal direction with the other hand apply counterpressre below the PSIS then slack has been taking we performed rhythmic springing against ASIS untill we felt it release.

For mobilization of lower part of the sacroiliac joint, patient is lying on side not being treated with flexed knee, with one hand therapist grasp the ASIS and with the ulnar aspect of the other hand takes up the lateral contact with dorsal end of sacrum, for mobilisation using rotating sacrum in related to ileum convergent movement of both hands and forearm after the slack has been taking we performed rhythmic movement untill we felt it release.

For gait training

We asked the patient to walk forward slowly and with semi flexed knees, contact with three points of heel, sole and tiptoes

We ask the patient to walk Backward slowly with contact of three point of toes, sole and heels

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PIR techniques for hypertonic muscles according to lewit M. Tensor fasciae latae, M. Hamstrings, M. Iliopsoas and M. Quadriceps (m. rectus femoris)

For strengthening exersise

Standing on bosu, patient is standing with semi flexed knees, hips and slight external rotation of hip and throw a small ball from hand to the other hand.

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Patient supine with flexed knee and arms at side raise pelvis off. Hold this position for a few seconds, then return the foot to the floor

For strengthening knee extensors muscles

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For strengthening hip Abductors muscles

By using thraband where the patient is standing attach elastic to secure object and at ankle level. then Stand with the non-involved leg beside the secure object, keep knee straight, pull away, moving leg in the dirction of abduction then slowly return to start position.

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Hydrotherapy, after exercising

Patient went for whirlpool Temperature 37 C to relax the muscles and soft tissues and anti-edema, duration 30 min.

All exercises were done 3 times 10 repetitions

At the end of exercising in the gym patient went for cycling for 10 min.

Results

Patient feels better with no pain we notice that he has more range of motion of knee joint than the previous visit and joint play improved so the mobility of the knee and sacroiliac joint was better, the strength of muscles was better.

Self-therapy

Patient can perform the stretching of hamstring and quadriceps by using belt at home to increase the length and can perform the strengthening of the weak muscles by using theraband as he learned

Date 28.1.2016

Goal of today's therapy unit

Improve ROM of knee, mobilisation of sacroiliac, left patella and head of fibula joints, stretching of knee flexor and extensor muscles, mobilization of deep fascia of thighs, lymph drainage, gait training, strengthening exercises of weak muscles, relaxation of hypertonic muscles and soft tissues.

Procedure

Patient in supine and using small ball under heel with asking the ptient to move his heel in direction of flexion of knee and hip.

Stretching connective tissues By Lewit, in left calf and shin, by placing both hands around the leg apllying little pressre and to take up the slack in the examind in dirction of rotation around the leg then to reach the barir wher the facia is restricted and wait for the release while patient is supine with semi flexed left knee.

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For mobilization of lower part of the sacroiliac joint, patient is lying on side not being treated with flexed knee, with one hand therapist grasp the ASIS and with the ulnar aspect of the other hand takes up the lateral contact with dorsal end of sacrum, for mobilisation using rotating sacrum in related to ileum convergent movement of both hands and forearm after the slack has been taking we performed rhythmic movement untill we felt it release.

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For gait training

We asked the patient to walk forward slowly and with semi flexed knees, contact with three points of heel, sole and tiptoes

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For strengthening exersise

Standing on bosu, patient is standing with semi flexed knees, hips and slight external rotation of hip and throw a small ball from hand to the other hand.

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For strengthening knee flexor muscles

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For strengthening hip Abductors muscles

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At the end of exercising in the gym patient went for cycling for 10 min.

Results

Patient feels better with no pain we notice that he is getting more range of motion of knee joint than the previous session and joint play improved so the mobility of the sacroiliac and knee joint was good, the strength of muscles was better.

Self-therapy

Patient can perform the stretching of hamstring and quadriceps by using belt at home to increase the length and can perform the strengthening of the weak muscles by using theraband as he learned.

5.6. Final kinesiologic examination

5.6.1. Aspection

Patient in good health condition, he doesn’t feel any pain, both knee was slight symmetrical.

5.6.2. Postural examination (by Kendal):

Anterior view:

-Weight baring slightly to the right side

-Slightly eversion of the right foot.

-Both knee in slighlty external rotation

- Both upper extremities are in slightly internal rotation

- Right shoulder is slightly higher than the left shoulder

-Angle space of the right hand is wider the left hand

Lateral view:

- Slightly semi flexed of the left knee joint

- Normal curves of spine

- Protracted of both shoulder

-Head forward

Posterior view:

- Weight baring slightly to the right side

- Pelvis tilted to the right side

- Whole spine is in mid line

- Winging of the left scapula

- Both upper extremities are in slightly internal rotation

- Right shoulder is slightly higher than the left shoulder

-Angle space of both hand is almost the same

Pelvis examination (by Kendal):

The position of the pelvic was slightly anterior tilt and tilted slightly to the right side.

5.6.3. Gait examination (by Kendal):

- Whole body limping to the right side
- He walks more on the lateral aspects of the foot
- There was more flexion of the knee on the right knee
- More loading on the left side
-Angle space of the right hand is wider the left hand during walking
-Winging of the left hand
-The rhythmic and length of steps was symmetrical

Modification of gait examination:

Walking on tip toes: Patient is able to do it with full extension of his left knee joint.

Walking with squats: Patient isn't able to do it. because of the limitation of the left knee joint.

5.6.4. Soft tissue examination (by Lewit):

- Skin and connective tissue of lower extremity (shin and calf) isn't restricted in both directions (medial and lateral) in the left leg.
- Deep facia of the thigh isn't restricted in both directions (medial and lateral) around the axis of the lower extremity in both legs.

5.6.5. Special tests:

2 scales test: R 36 kg L 34 kg

Trandelburg's test: The patient was able to perform the test on right and the left side. So, the test was negative in both side.

Romberg test:

I negative

II negative

III negative

5.6.6. Anthropometry examination (by Kendal):

Measurement	Right lower extremity	Left lower extremity
Anatomical length	83 cm	83 cm
Functional length	86 cm	86cm
Length of the thigh	43 cm	43 cm
Length of the middle leg	40 cm	40 cm
Length of the foot	22 cm	22 cm
Circumference of thigh Quadriceps	49 cm	48 cm
Vastus Medialis	45 cm	43 cm
Circumference of knee joint	39 cm	40 cm

Table No. 9 – Final anthropometric measurement for length and circumference of lower extremity [cm]

5.6.7. Palpation examination (by Kendal):

Muscle	Position	Left side	Right side
M. Quadriceps (m. rectus femoris)	Supine	Less Hypotonic	Normal tonus
M. Tensor fasciae latae	Supine	Less Hypertonic	Hypertonic
M. Adductors (m. adductor longus,	Supine	Normal tonus	Normal tonus

magnus, brevis)			
M. Hamstrings	Prone	Less Hypotonic	Normal tonus
M. Iliopsoas	Supine	Hypertonic	Hypertonic
M. Gastrocnemius	Prone	Normal tonus	Normal tonus
M. Gluteus maximus	Prone	Normal tonus	Normal tonus
M. Piriformis	Prone	Normal tonus	Normal tonus

Table No.10 – Final examination of muscle tone by Lewit

5.6.8. Range of motion examination (by Kendal):

Ankle				
Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Plantar flexion	50 ^{o}	52 ^{o}	57 ^{o}	58 ^{o}
Dorsi flexion	19 ^{o}	20 ^{o}	24 ^{o}	25 ^{o}
Foot inversion	13 ^{o}	15 ^{o}	20 ^{o}	23 ^{o}
Foot eversion	10 ^{o}	10 ^{o}	15 ^{o}	15 ^{o}

Table No.11 – Final range of motion examination of ankel by Kendal

Hip				
Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion	100 ^{o}	110 ^{o}	115 ^{o}	120 ^{o}
Extension	10 ^{o}	10 ^{o}	15 ^{o}	15 ^{o}
Adduction	23 ^{o}	25 ^{o}	27 ^{o}	30 ^{o}
Abduction	40 ^{o}	45 ^{o}	55 ^{o}	57 ^{o}

External Rotation	40 ^{o}	40 ^{o}	45 ^{o}	45 ^{o}
Internal Rotation	40 ^{o}	40 ^{o}	45 ^{o}	45 ^{o}

Table No.12 – Final range of motion examination of hip by Kendal

Knee				
Movement	Active Movement		Passive Movement	
	Left side	Right side	Left side	Right side
Flexion	60 ^{o}	130 ^{o}	70 ^{o}	143 ^{o}
Extension	0 ^{o}	-10 ^{o}	0 ^{o}	-5 ^{o}

Table No.13 – Final range of motion examination of knee by Kendal

Rotations in hip on left side were not done by goniometer (due to patient condition) while he couldn't do knee flexion until 90 degrees. So, we do it evaluational by semiflexed left knee, while patient is supine.

5.6.9. Muscle strength examination (by Kendal):

Muscle	Right lower extremity	Left lower extremity
M. Quadriceps femoris	5	4
M. Hamstrings	5	4
M. Adductors	5	4+
M. Tensor fasciae latae	5	4
M. Gastrocnemius	5	4
M. Iliopsoas	5	4+
M. Gluteus maximus	4	4
M. Gluteuse medius	4	4

Table No. 14 – Final muscle strength examination by Kendal**.**

5.6.10. Muscle length examination (by Janda):

Muscle	Right lower extremity	Left lower extremity
M. Quadriceps femoris	0	1
M. Hamstrings	1	1
M. Adductors	0	0
M. Tensor fasciae latae	0	1
M. Gastrocnemius	0	0

Table No. 15 – Final muscle length examination by Janda

5.6.11. Neurological examination (by Lewit):

Deep sensation test: Position sense: it was examined of both lower extremities it was negative in all joints. Sterognosis: he was able to recognise the objects by both hands and feet. Both are negative. Graphesthesia: he was able to recognise what was written on both hands and both lower extremities. Both are Negative.

Babinski reflex was also negative/without pathological findings.

Rhomberg test: I, II, III are Negative

Superficial sensation test: light touch: it was examined on both lower extremities on the inner and outer aspects. The test is Negative

Examination of deep tendon reflexes (by Lewit):

After having completed a standard testing of reflexes however, the reflex of the left and right lower extremity were normal 2 reflex of Patellar tendon and normal 2 reflex of Achilles tendon as well as the Plantar 2 reflexes showed physiological and symmetrical response.

5.6.12. Joint Play Examination (by Lewit):

Joint	Left side	Right side
Sacroiliac	No restriction in all directions	No restriction in all directions
Patella	No restriction in all directions	No restriction in all directions
Head of fibula	No restriction in all directions	No restriction in all directions
Talocrural	No restriction	No restriction
Subtalar	No restriction	No restriction
Chopar't	No restriction	No restriction
Lisfranc's	No restriction	No restriction
Metatarsophalangeal	No restriction in all directions	No restriction in all directions
Interphalangeal	No restriction in all directions	No restriction in all directions

Table No. 12 - Final joint play examination by Lewit.

6. THERAPY EFFECT EVALUATION, PROGNOSIS

After sixth session working with the patient it was noticeable the progression of his case starting from the range of motion that was increased flexion 60° and extension 0° in the active movement, passively we can see its better flexion 70° and extension 0°. The strength of the muscles was increased than before, the quadriceps and hamstrings on the left leg (grade 4 by Kendall). the hypertonic muscles were relaxed after PIR techniques. There was improvement of joint play no more restriction of joint play in patella, Sacroiliac and Head of fibula joints. There was no restriction of connective tissues and fascia on the thighs and leg. The swelling around the knee cap is much better now it is 40 cm in circumference. the stretching of shortened muscle has increased especially quadriceps muscle. At the end the patient has improved his gait and it was better than before.

If the patient is continuing the rehabilitation plan and keeping exercises daily at home, we expect that he could restore more of range of motion of the knee flexion.

Patient was motivated and working hard exercising well and looking forward to go through the plane of the therapy.

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8. Supplements

8.1. List of figures

8.2. List of tables

8.3. Abbreviations

ABD: abduction

ABDrs: abductors,

ADD: adduction

ADDrs: adductors,

BMI: body mass index.

DFrs: dorsal flexors

E: extension

ER: external rotation

F: flexion,

IPJ: interphalangeal joint

IR: internal rotation

MLT: muscle length test

MPJ: metatarsophalangeal joint

MST: muscle strength test

PFrs: plantar flexors

PIR: post isometric relaxation

ROM: range of motion

TFL: tensor fascia latae

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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 ……., 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 ……

Cílem této bakalářské práce je ……

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 .....

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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 Patient with Diagnosis After Total Knee Replacement on Left Side

Project form: bachelor
Period of realization of the project: 2016
Applicant: Mohammad AlQarni
Main researcher: Mohammed AlQarni
Co-researcher(s):
Supervisor (in case of student's work): PhDr. Jitka Mala, PHD, PhDr. Edwen Maher, PHD
Financial support:

Project description: My project is about a patient after Total Knee Replacement on Left Side. He is treated at the clinic „Centrum léčby pohybového aparátu mediterra" (CLPA Mediterra) Praha 9.

Applied procedures: initial kinesiological examinations and therapy with my supervisor according to his instructions And according to the hospital protocol and the recommended therapy in the case of the patient was consentrating about Exercises for limited ROM of knee joint, strengthening muscle techniques, mobilisation for restricted joints, relaxing therapy for hypertonic muscles, Soft tissue techniques, stretching techniques and gait training And correcting the patient walking and posture then the evaluation of the therapy progress at the end of the therapy.

Ensuring safety within the research: No invasive methods with the patient are used. Supervision is provided by the supervisor PhDr. Edwen Maher, PHD. All methods are according to the hospital protocol.

Ethical aspects of the research: The patient is adult and he is non-vulnerable. All his personal data will be anonymised

Informed Consent: attached

It is a 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, 6.12.2016 Applicant's signature:

Approval of UK FTVS Ethics Committee

The Committee: Chair: doc. PhDr. Irena Parry Martinková, Ph.D.
Members: prof. PhDr. Pavel Slepička, 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: 227/2016

Date of approval: 8.12.2016

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.

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– 20 –

Signature of the Chair of
UK FTVS Ethics Committee