Charles University

Faculty of Physical Education and Sports

Case Study of Physiotherapy Treatment of Closed Patella Fracture

Bachelor's Thesis

Prague, September 2012

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Supervisor: Mgr. Klara Hojkova

Abstract

Title:

A Case Study of Physiotherapy Treatment of Closed Patella Fracture

Thesis Aim:

This thesis involves a case study on physiotherapeutic approach to a 35 year old male with closed patella fracture, 8 weeks after incident. This case study was conducted in the month of January of 2012 at Ústřední Vojenská Nemocnice under the supervision of physiotherapist Martina Puchmertlova. Materials used during this study include treatment table, measurement tape, neurological hammer, goniometer, overball, various sized pillows, and balance boards of different shape. The theoretical part aims to explain anatomical structure, biomechanics, kinesiology and etiology of this type of fractures. While the practical part refers to the case study; the examinations used and the effectiveness of the therapy with the approaches used.

Methods:

The therapy started with initial kinesiological examination. Along with the therapeutic methods taught at the Faculty of Physical Education and Sport, the chosen procedures included: post isometric relaxation and stretching by Lewit, soft tissues techniques by Lewit, sensomotoric training and mobilization by Lewit. Lastly final kinesiological examination was conducted. To enhance the effects of the therapy, the patient has been in addition required to perform home therapies as instructed during the sessions.

Results:

The therapies used have shown to be very successful concerning the patients diagnosis.

Keyword:

Knee, patella, patella fracture, case study, physiotherapy

Declaration

I hereby declare that this work is my own individual work, under the guidance of consultant Mgr. Klara Hojkova, based on my knowledge gained from books, journals, reports and attending lectures and seminars at FTVS.

I also declare that no invasive methods were used during the practical treatment and that the patient was fully aware of the procedures at all times.

Prague, September 2012

Acknowledgments

First of all I wish to thank my partner and my family for their tremendous support, and motivation to keep me going. Both during the course of this case study as well as the years I spent in Prague.

Secondly I wish to thank all my friends in Prague for their patients and kindness. I wouldn't have survived without them.

I would like to deeply thank all my professors at FTVS, whom I have encountered over the years, for sharing their knowledge and experience with me.

Last but not least I wish to thank my supervisor at Ústřední Vojenská Nemocnice Mrs. Martina Puchmertlova for helping me with my patients and teaching me new techniques to expand my knowledge.

And a special thank you for Mgr. Klara Hojkova for guiding me every step of the way and helping me with my thesis. Your help was very much appreciated.

Thank You all for your support

Umit Caliskaner

Prague, September 2012

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2. General Part:

2.1Introduction to knee joint

The knee is the largest synovial joint of the body. It is also one of the most complex. It lies midway along the lower extremity and permits flexion to occur within the lower extremity. The knee joint is composed of 3 bones, the femur, tibia and patella. It has two articulations which are the tibiofemoral and the patellofemoral articulations. (1)

2.2 Anatomy of Knee joint:

2.2.1 Bones:

The knee joint is composed of three bones. They are tibia, femur and the patella. Femur is connected at proximal to the hip and at the distal to the knee. The distal part of femur meets the proximal part of tibia, creating the tibiofemoral joint. The tibiofemoral joint is formed by two large, bulbous femoral condyles resting on a relatively flat tibia plateau**.** (1) This region is called the medial and lateral tibiofemoral articulations. They lay between the lateral and the medial femoral and tibial condyles.

The tibial plateau is characterized by curved surfaces sponding to the medial and lateral femoral condyles. The lateral tibial plateau is convex in shape. This allows the lateral femoral condyle to move further backward than the medial condyle. This causes internal tibial rotation with flexion. (5)

This joint is classified as a hinge joint, and is supported by ligaments for stability. The tibiofemoral joint can potentially move in four directions. These movements are stabilized and limited by muscles and ligaments and accessory soft tissue such as the menisci.

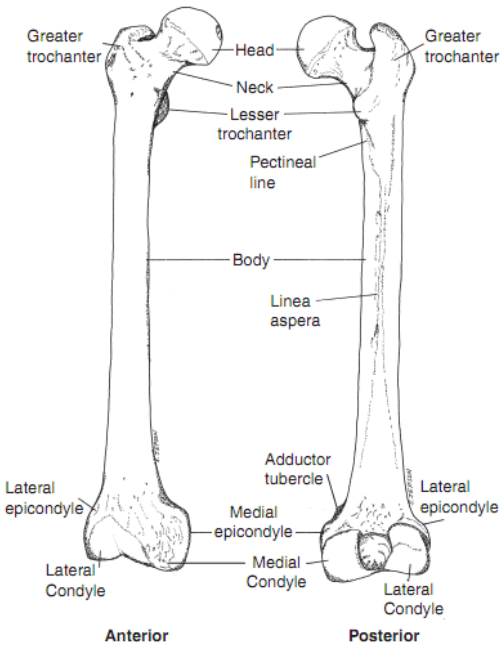

Figure 1 - Anterior and Posterior view of Femur (2)

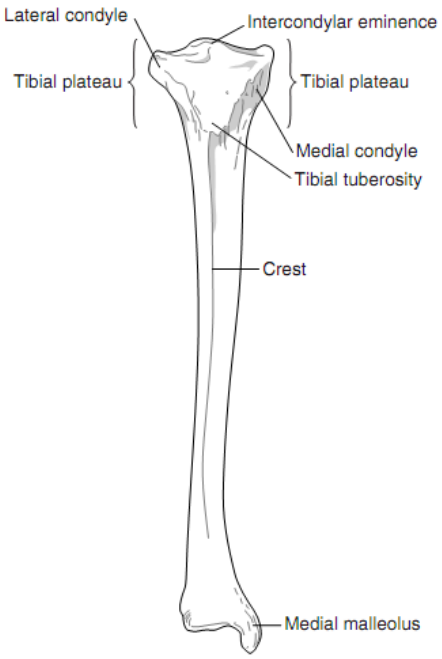

Figure 2 - Posterior View of Tibia (2)

The patella is a triangular-shaped sesamoid bone within the quadriceps muscle tendon. It has a broad superior border and a somewhat pointed distal portion**.** The articulation between the femur and patella is referred to as the patellofemoral joint. The

posterior surface of the patella is smooth and glides over the patellar surface of the femur. (2)

The articular surface of the patella has two facets divided by a ridge, which helps with tracking over the condyles. (5) The patella's main functions are to increase the mechanical advantage of the quadriceps muscle and to protect the knee joint. (2)

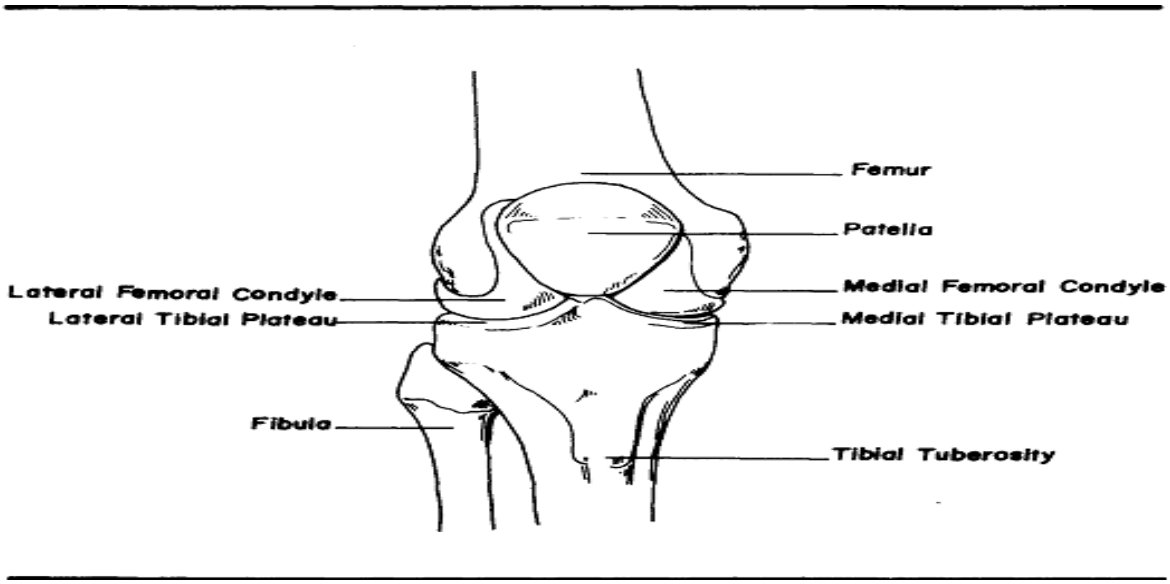

Figure 3 - Picture of all bones in knee (18)

2.2.2 Joint Capsules

The joint capsule consists of a fibrous capsule and an internal synovial membrane that encloses the knee joint. It covers all internal surfaces of the articular cavity not covered with articular cartilage. This layer has a few thickened parts that make up intrinsic ligaments.

The extensive synovial membrane of the capsule lines all surfaces bounding the articular cavity not covered by articular cartilage. "It attaches to the periphery of the articular cartilage covering the femoral and tibial condyles; the posterior surface of the patella; and the edges of the menisci, the fibrocartilaginous discs between the tibial and the femoral articular surfaces. It lines the internal surface of the fibrous layer laterally and medially, but centrally it becomes separated from the fibrous layer." (6)

2.2.3 Ligaments:

The joint capsule is strengthened by five external ligaments.

The patellar ligament is the distal part of the quadriceps tendon and it is a strong fibrous band passing from the apex of patella to the tibial tuberosity. This ligament lies on the anterior side of the knee, covering the patella. “Laterally, it receives the medial and lateral patellar retinacula, aponeurotic expansions of the vastus medialis and lateralis and overlying deep fascia. The retinacula make up the joint capsule of the knee on each side of the patella and play an important role in maintaining alignment of the patella relative to the patellar articular surface of the femur”. (6)

Lateral collateral ligament (LCL also know as fibular collateral ligament), is a very strong extracapsular ligament. It is round and cordlike and it extends inferiorly from the lateral epicondyle of the femur to the lateral surface of the fibular head. The tendon of the popliteus passes deep to the LCL, separating it from the lateral meniscus. The tendon of the biceps femoris is split into two parts by this ligament. (6)(2) The LCL is the primary restraint to varus stress in the knee to 0-30° of knee flexion and secondarily resists internal rotation of the tibia. (11)

Medial collateral ligament (MCL also known as tibial collateral ligament) “is a strong, flat, intrinsic band that extends from the medial epicondyle of the femur to the medial condyle and the superior part of the medial surface of the tibia.” The medial collateral ligament has fibers that attach to the medial meniscus. (6) The MCL provides primary restraint to valgus stress at knee. (12)

The MCL divided into two parts, superficial and deep. Superficial ligament can be divided into anterior posterior portions where the anterior fibers of superficial portion of ligament appear to tighten with knee flexion of 70 to 105° .Posterior fibers form the posterior oblique ligament. (12)

The oblique popliteal ligament “is a recurrent expansion of the tendon of the semimembranosus that reinforces the joint capsule posteriorly as it spans the intracondylar fossa. The ligament arises posterior to the medial tibial condyle and passes superolaterally toward the lateral femoral condyle, blending with the central part of the posterior aspect of the joint capsule”. (6)

The arcuate popliteal ligament also strengthens the internal capsule posterolaterally. It arises from the posterior aspect of the fibular head, passes superomedially over the tendon of the popliteus, and spreads over the posterior surface of the knee joint. (6)

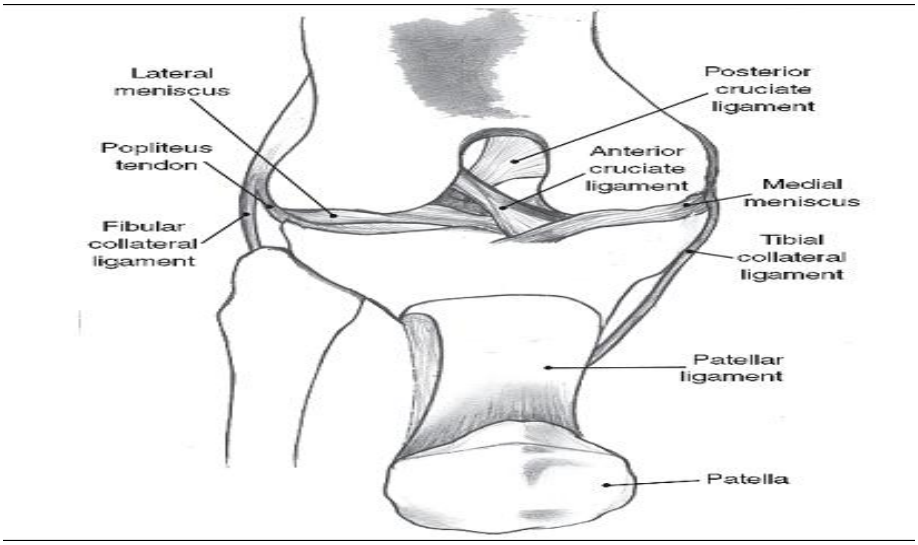

Figure 4 - External Ligaments of the knee joint (5)

Internal Ligaments:

The intra articular ligaments within the knee joint consist of the cruciate ligaments and menisci.

The cruciate ligaments cross within the knee joint, outside the synovial cavity. The cruciate ligaments are located in the center of the joint and cross each other like letter X. "Because of their oblique orientation, in every position one cruciate ligament, or parts of one or both ligaments, is tense". (6)

The anterior cruciate ligament (ACL) is the weaker of the two cruciate ligaments that arises from the anterior intercondylar area of the tibia. It extends superiorly, posteriorly, and laterally to attach to the posterior medial side of the lateral condyle of the femur. The primary function of the ACL is to restrain anterior tibial subluxation. It limits posterior rolling of the femoral condyles on the tibial plateau during flexion,

converting it to spin. It also prevents hyperextension of the knee joint. Flexion and external rotation (separately) loosens the ACL, while full extension and internal rotation tightens it. (6)(5)

The posterior cruciate ligament (PCL), "is the stronger of the two cruciate ligaments, arises from the posterior intra condylar area of the tibia. The PCL passes superiorly and anteriorly on the medial side of the ACL to attach to the anterior part of the lateral surface of the medial condyle of the femur. The PCL limits anterior rolling of the femur on the tibial plateau during extension, converting it to spin." It also prevents hyperextension of knee and in loading knee it helps stabilize the femur. It prevents the tibia to be posteriorly displaced on femur and femur to be anteriorly displaced on tibia. And as opposite of ACL, it tightens during flexion of knee joint. (6)(2)

The medial meniscus "is C shaped, broader posteriorly than anteriorly. Its anterior horn is attached to the anterior intercondylar area of the tibia, anterior to the attachment of the ACL. Its posterior end is attached to the posterior intercondylar area, anterior to the attachment of the PCL. The medial meniscus firmly adheres to the deep surface of the TCL. Because of its widespread attachments laterally to the tibial intercondylar area and medially to the TCL, the medial meniscus is less mobile on the tibial plateau than is the lateral meniscus". (6)

The lateral meniscus "is nearly circular, smaller, and more freely movable than the medial meniscus. The tendon of the popliteus has two parts proximally. One part attaches to the lateral epicondyle of the femur and passes between the lateral meniscus and inferior part of the lateral epicondylar surface of the femur and the FCL that overlies its lateral aspect. The other, more medial part of the popliteal tendon attaches to the posterior limb of the lateral meniscus. A strong tendinous slip, the posterior menisco femoral ligament, joins the lateral meniscus to the PCL and the medial femoral condyle." (6)

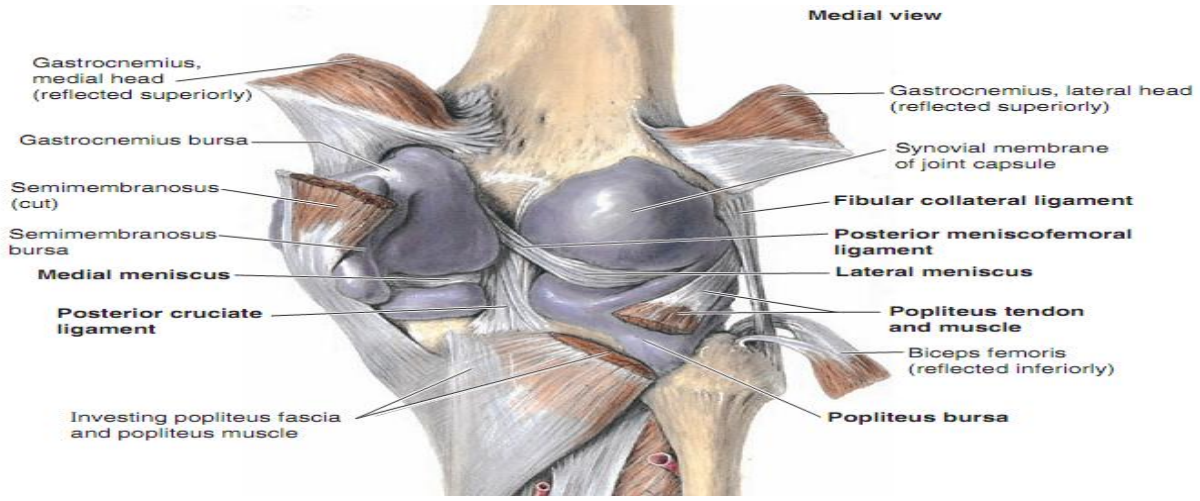

Figure 5 - Internal Ligaments of the knee joint (6)

2.2.4 Bursae:

Numerous bursae are related to the knee joint.. There are four situated in front and six behind the joint. (13) The four bursae situated in front of the joint are the subcutaneous prepatellar bursa, the suprapatellar bursa, the cutaneous prepatellar bursa, and the deep infrapatellar bursa. “The broad oblique popliteal ligament and the arcuate popliteal ligament are superficial in position, whereas the anterior and posterior cruciate ligaments lie deep within the joint. The popliteal bursa and the semimembranosus bursa are the two bursae associated with the back of the knee.” (7)

Rest of the posterior bursae are found in relationship with tendons of biceps femoris, Sartorius, gracilis and semitendinosus under the lateral head of gastrocnemius muscle on tibia. (13)

2.3 Kinesiology Of The Knee Joint:

Three types of arthrokinematic motion are used during knee flexion and extension. The convex femoral condyles move on the concave tibial condyles, or the other way around depending upon whether it is an open - or closed- chain activity. The articular surface of the femoral condyles is much greater than that of the tibial condyles. If the femur rolled on the tibia from flexion to extension, the femur would roll off the tibia before the motion was complete. Therefore, the femur must glide posteriorly on the tibia as it rolls into extension. As extension occurs, the articular surface of the femoral lateral condyle is used up while some articular surface remains on the medial condyle. Therefore, the medial condyle of the femur must also glide posteriorly to use its entire articular surface. It is this posterior gliding of the medial condyle during the last few degrees of weight-bearing extension (closed chain action) that causes the femur to spin medially on the tibia. Looking at the same spin, or rotational, movement during non–weight-bearing extension (open-chain action), the tibia rotates laterally on the femur. These last few degrees of motion lock the knee in extension, which is sometimes referred to as the screw-home mechanism of the knee. With the knee fully extended, an individual can stand for a long time without using muscles. The knee must be "unlocked" by the femur rotating laterally on the tibia for knee flexion to occur. It is this small amount of rotation of the femur on the tibia, or vice versa, that keeps the knee from being a true hinge joint. Because this rotation is not an independent motion, it will not be considered a knee motion. (2)

"The knee joint fulfills two contradictory postulates: stability and mobility at the same time. This enables the structure of the joint: the form of the condyles, the menisci, collateral and crucial ligaments. The capsule of the knee joint is indented with many recess and bursae, where liquid may be stored. Slacking of ligaments causes the wobbly knee joint. The patella is important mechanically, improving the function of m. quadriceps femoris in extension during uprising.

In normal standing is patella free and movable, because the stability is kept by activity of distal muscles. If patella is not movable, it testifies some worsened stabilization of the posture requiring more energy than necessary. In sportsman exercising springing, patella is also not free. Position of patella draws the attention the position of femoral head in the hip joint. The function in the hip involves the knee as well as the foot. The knee joint may by lightly flexed or extended or deviated laterally or medially due to the changes in the bones in the joint and also the balance of the muscles around the joint.

The knee joint must sustain the weight of the whole body in walking and running and even more when the body is lifted actively against the gravity. The knee joint is more vulnerable n extension, because the ligaments are strained and may burst and also menisci may burst by downfall and cause often posttraumatic knee troubles." (8)

2.4 Biomechanics of patellofemoral joint

The patella serves two important biomechanical functions in the knee. First, it aids knee extension by producing anterior displacement of the quadriceps tendon throughout the entire range of motion, thereby lengthening the lever arm of the quadriceps muscle force. Second, it allows a wider distribution of compressive stress on the femur by increasing the area of contact between the patellar tendon and the femur. (9)

The location of the patellar contact zone shifts from distal to proximal during flexion, which means that the fulcrum changes constantly in its point of support. This not only leads to a constantly shifting contact location on the patellar cartilage, but also to a differential torque in both the patellar and quadriceps tendon. With regard to patellar and quadriceps tendon torque, the patella therefore acts as a balancing beam, with relatively higher patellar tendon forces at small flexion angles, and relatively higher quadriceps tendon forces at larger flexion angles. (10)

As the knee flexion increases, the center of gravity shifts further away from the center of rotation, thereby greatly increasing the flexion moment to be counterbalance

by the quadriceps muscle force. As the quadriceps muscle force rises, so does the patellofemoral joint reaction force.

The joint reaction force was much greater during activities that require greater flexion. During knee bend to 90°, this force reached 2.5 to 3 times body weight with the knee flexed at 90 °. Throughout knee bend, the patellofemoral joint reaction force remains higher than the quadriceps muscle force. (9)

2.5 List Of Muscles Around the Knee Joint: (2)(6)(13)

Anterior Muscle Group

Name	Origin	Insertion	Primary Movement	Nerve
Rectus Femoris	AIIS	Tibial Tuberosity via Patellar Tendon	Hip Flexion and Knee Extension	Femoral Nerve (L2,L3,L4)
Vastus Lateralis	Linea Aspera	Tibial Tuberosity via Patellar Tendon	Knee Extension	Femoral Nerve (L2,L3,L4)
Vastus Medialis	Linea Aspera	Tibial Tuberosity via Patellar Tendon	Knee Extension	Femoral Nerve (L2,L3,L4)
Vastus Intermedialis	Anterior Femur	Tibial Tuberosity via Patellar Tendon	Knee Extension	Femoral Nerve (L2,L3,L4)

Table 1: List of Anterior Muscle Group of the knee

Posterior Muscle Group

Name	Origin	Insertion	Primary Movement	Nerve
Semimembranosus	Ischial Tuberosity	Posterior surface of medial condyle of tibia	Knee flexion and Hip Extension	Sciatic Nerve (L5,S1,S2)
Semitendinosus	Ischial Tuberosity	Anteromedial surface of proximal tibia		Sciatic Nerve (L5,S1,S2)
Biceps Femoris	Long Head: Ischial tuberosity Short Head: lateral lip of linea aspera	Head of fibula	Long Head: knee flexion and hip extension Short Head: knee flexion	Long Head: Sciatic Nerve (L5,S1,S2) Short Head: common peroneal nerve (L5,S1,S2)
Gastrocnemius	Medial and Lateral condyles of Femur	Posterior Calcaneus	Ankle plantar flexion, knee flexion	Tibial Nerve (S1,S2)

Table 2: List of Posterior Muscle Group of the knee

Medial Group

Name	Origin	Insertion	Primary Movement	Nerve
Sartorious	Pubis	Middle third of the linea aspera	Hip Adduction and participates in flexion of the knee joint.	Femoral Nerve (L2,L3)
Gracilis	Inferior Ramos of Pubis	Superior part of medial surface of Tibia	Hip Adduction	Obturator Nerve (L2,L3)
Popliteus	Lateral Condyle of Femur	Posteromedial Condyle of Tibia	Initiates Knee flexion	Tibial Nerve (L4,L5,S1)

Table 3: List of Medial Muscle Group of the knee

2.6 List of ligaments around the knee joint:

Patellar Ligament
Medial Collateral Ligament
Lateral Collateral Ligament
Oblique Popliteal ligament
Arcuate popliteal ligament
Anterior Cruciate Ligament
Posterior Cruciate Ligament
Medial Meniscus
Lateral Meniscus

Table 4: List of Ligaments around the knee

2.7 Introduction to Patella Fractures (Etiology)

Fractures of the patella account for approximately 1% of all skeletal fractures. Patella's anterior location and thin overlying soft tissue makes it prone to injuries from direct trauma. (4)

The major mechanisms that usually cause patellar injuries are either direct trauma, indirect force or combined. The direct trauma can be further divided into high and low-energy collisions, where the low energy force can be falling from sitting or standing height and the high energy can be car crash as an example. Comminuted fracture patterns are often the result of high-energy direct injuries. **(**4) (14)

"Indirect injury can occur secondary to the large forces generated through the extensor mechanism and typically result from forceful contraction of the quadriceps with the knee in a flexed position. The substantial force generated by a violent quadriceps contraction fractures the patella and may propagate through the adjacent retinaculum of the extensor mechanism." (4)

The principal goal of the patella fracture treatment is the surgical restoration of the extensor mechanism and anatomic reconstruction of the articular surface. (22)

2.7.1Classifications:

In principle one can distinguish the transverse patella fractures, comminuted fractures where the bone is shattered in to multiple pieces, longitudinal fractures and osteochondral fractures where the cartilage covering the end of a bone in a joint is torn. (15)

Patellar fracture classification is typically descriptive in nature and can be based on fracture pattern, degree of displacement, or mechanism of injury. Different classification systems exist and the OTA classification system is universally accepted. Neither this scheme nor any other classification system has been shown to correlate fracture pattern with clinical outcome. For this reason, most clinical series have reported outcomes based on the type of fixation rather than fracture pattern. Alongside OTA

classification system, there is also AO, Speck and Regazzon and Rogge, Oestern & Gossé classifications. (4)(15)

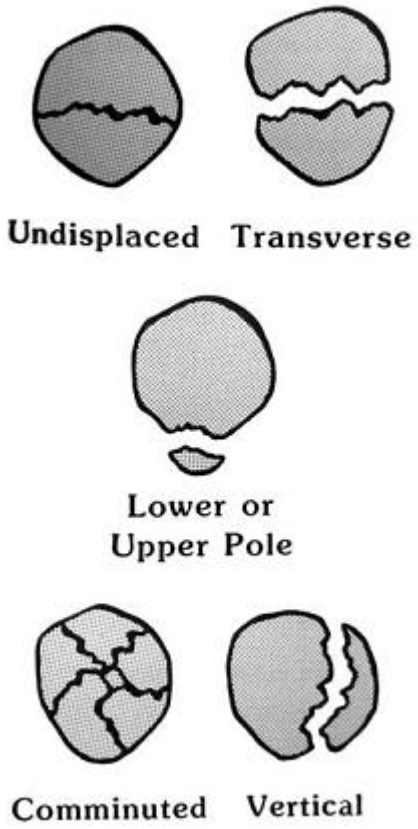

Figure 6 - Saunders Classification of Patella Fracture (14)

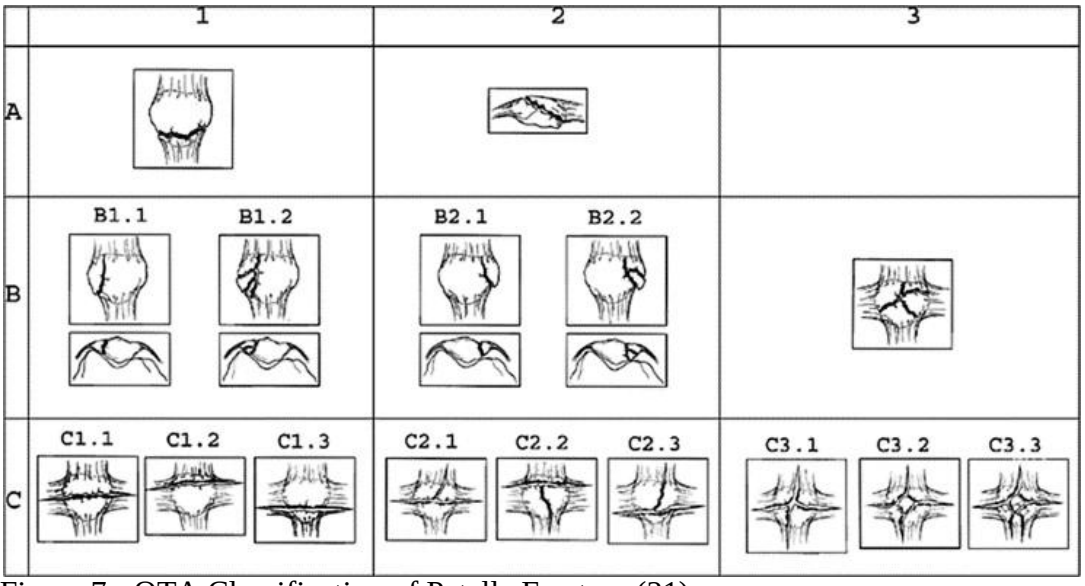

Figure 7 - OTA Classification of Patella Fracture (21)

2.7.2 Diagnosing:

Diagnosing patella fractures are done by examination of the patient. Usual symptoms include pain, swelling over the knee, inability to walk or extend knee against gravity (straight leg raise). Displaced patella fractures typically present with an acute hemarthrosis and a tender, palpable defect between the fracture fragments. Depending on type of injury soft tissue damage is also visible. Most patella fractures can be adequately visualized and classified using standard anteroposterior, lateral, and Merchant patellofemoral axial radiographs of the knee. The anteroposterior view helps assess the fracture pattern and the direction of displacement, while the lateral and Merchant views assist in understanding the amount and location of comminution. (15) (4)

2.7.3 Treatments

The treatment of patella fractures depends on the type of fracture. After careful examination and X-Ray pictures the treatment can be either surgical or non surgical. Main goal of treatment is restoring the function of the knee back to normal function. Main indications of choosing type of treatment for non-surgical are: (23)

- Undisplaced fracture with intact articular surface
- Preserved extensor mechanism

- There should be minimal displacement of fragments (2-3 mm) as well as minimal disruption of the articular surface (2-3 mm)
- Non torn retinacula on either sides of patella

"Typically, non-surgical treatment involves application of well-padded immobilization (cast, splint, knee immobilizer) in nearly full extension for 4 to 6 weeks. Weight bearing as tolerated is permitted, and isometric quadriceps exercises along with straight-leg raises are begun within 1 week of injury. When consolidation is evident on follow-up radiographs, active range-of-motion exercises are encouraged." (24)

If the patella is displaced, you will most likely need surgery. Fractured patellar bones that are not close together often have difficulty healing or may not heal. Other indication for surgical treatments is:

- Patellar fractures with greater than 3 mm of fragment displacement
- Greater than 2 mm of articular incongruity
- Extensor mechanism dysfunction
- Osteochondral fractures with associated intra-articular loose bodies

The surgical treatments can include internal or external fixation, partial or total patellectomy. (4) (15) (23)

"The goals are to provide adequate reduction with stable fixation while preserving a viable soft tissue envelope to allow early rehabilitation and uneventful healing." (24)

Internal fixation of patella

The internal fixation of patella procedure uses different types of wires, bands or screws depending on the alignment of the injury. The most used type of internal fixation is called tension band technique and includes Kirschner wires and tension band. The tension band technique often begins with placing 2 parallel Kirschner wires (K-wires). Once the K-wires are placed, a 1-mm or 1.25-mm tension band wire is placed as close to the border of the patella as possible. Keeping the tension band at the anterior half of the patella is very important. The tension band is made into the shape of a figure of 8 or figure of 0. It should lie as close to bone as possible throughout its entire course. A 14- or 16-gauge intravenous catheter facilitates the passage of the wire through the soft

tissue. Modifications of tension band technique include the use of cannulated screws instead of K-wires. This may allow for compression across stable fractures. (4) (24)

External Fixation of Patella

"The use of external fixator techniques with patellar fracture has been described in cases of a compromised soft tissue envelope and open injury with contamination. In such severe circumstances, standard internal fixation may result in septic arthritis, failure of fixation, or further soft tissue compromise" (24) A four-hook external fixation compression clamp or percutaneous screw fixation with olive wires are then used for this procedure.

Partial Patellectomy

When comminution of the distal pole or a fragment of the patella is extensive and cannot be stabilized with internal fixation, a partial patellectomy should be performed. (24) "Care is taken to preserve as many large, viable fragments as possible. Retained fragments are anatomically reduced and secured to one another with screws or K-wires. If the comminution primarily involves the central patella with preserved proximal and distal fragments, the central comminution can be excised and the remaining fragments secured as congruously as possible with screw fixation." (4) Patients should expect a significant loss of extensor strength postoperatively. (23)

Total Patellectomy

Total patellectomy should be reserved as a salvage procedure when comminution is so severe that it is technically impossible to retain any congruous fragments of patella at the articulation with the trochlea. If a total patellectomy is required, all bony fragments are removed, with care being taken to preserve the retinacula and restore the integrity of the extensor mechanism.

Functionally, the soft tissue contribution of the extensor mechanism is lengthened with total patellectomy.

Complications After Fracture

Different type of complications can occur after patella fracture surgery, the most common being loss of knee motion also known as knee stiffness. This includes loss of knee flexion and quadriceps weakness. This may have extrinsic or intrinsic causes. Extrinsic involving soft tissues, capsules, ligaments or and muscles. In intrinsic on the other hand has cartilaginous or osseous origin. For this type of complication an aggressive postoperative program promoting early range of motion and quadriceps strengthening is recommended. (4) (22) (24)

Second type of complication is infection. This complication occurs rarely on closed fractures but on open fractures have a incident rate between 3 – 10 %. "The infections severity depends on the depth of the infection, the adequacy of the soft tissue envelope, the extent of bony involvement, and the virulence of the infection organism. The risk of an infection factors that are associated with the mechanism of the injury, the treatment and with the quality of the host itself. "

Loss of fixation prior to healing is reported to be between 0 - 20%. "This may be related to technical errors, unrecognized injury, or patient noncompliance. If displacement is minimal, a period of immobilization may be indicated to allow the remaining reduction to heal. If displacement is severe or discontinuity of the extensor mechanism is noted, revision surgery is indicated." (24)

Osteoarthritis during postoperative patella fracture is not an uncommon complication. Incident rate is high and posttraumatic osteoarthritis can be the sequelae of patellar fractures (4). The development of osteoarthritis has several factors. Severe articular cartilage damage at the time of injury as well as inadequate reduction and restoration of articular congruity can cause osteoarthritis. Exuberant callus during healing may also contribute to degenerative joint disease. (4) (24) (22)

Hardware irritation of the surrounding soft tissue is very common. Wires and wire knots can cause irritation and if it is necessary it should be removed.

Non or delayed union is When the broken bone fails to heal it is called a "nonunion." A "delayed union" is when a fracture takes longer than usual to heal. With today's fixation techniques, it is very rare complication. If delayed union is present, a period of immobilization will often allow healing to progress. If this fails, revision fixation with bone grafting should be considered. (24)

Physiotherapeutic approach to patella fractures

Physiotherapeutic procedures starts right after the surgery, if was a surgery, for postoperative care of the patient. The therapist must asses vascular and respiratory care, and general mobility.

Postoperative therapy is not the same for everyone, it is individual. Most important part of postoperative care is joint motion, swelling, scar and strengthening. Patient should be able to feel safe, and the therapist should not do anything to worsen the healing process. (25)

Joint motion is done by therapist or by using special designed machines that will help the patient regain full ROM, if this is not achieved, the therapist will continue ROM increasing therapy.

Swelling after surgery should be assessed by positioning or massage.

Scar should be done as soon as it is healed to achieve skin mobility. For general knee surgery including patellar surgery, these guidelines can be followed to give an indication of therapy

Rehabilitation Protocol
Nonoperative Patella Fracture

Weeks 0–6

- Continue icing until effusion resolves.
- Wear a straight-leg cylinder cast for 2–3 wk or controlled motion brace locked at 0 degrees in a very compliant patient.
- Allow weight-bearing to tolerance with crutches.
- Employ a ¼-inch heel lift (shoe insert) on the *contralateral* extremity to help with ground clearance of the involved "stiff" leg.
- Begin quadriceps sets, gluteal sets, hamstring sets, and SLR in all planes (supine and standing) before discharge from the hospital (quadriceps sets help decrease adhesion formation during the healing process).
- May begin open- and closed-chain exercises with the cast on, especially for hip strengthening.
- Replace cast with controlled motion brace at 2–3 wk.
- Begin electrical muscle stimulation for quadriceps reeducation.
- Progress weight-bearing to tolerance with crutches to weight-bearing with the use of a cane.
- In general, begin strengthening and ROM exercises at week 3 or 4 (open- and closed-chain exercises).
- Begin gentle patellar mobilization; the patient should be independent with this exercise.
- At approximately 6 wk, begin stationary bicycling with the seat elevated and no resistance for ROM and strengthening.
- Begin isokinetic exercises at speeds of 60–120 degrees/sec to strengthen the quadriceps musculature and decrease the forces on the patellofemoral joint that occur at lower speeds.
- Use stool scoots for hamstring strengthening.

Weeks 6–12

- Begin and progress closed-chain exercises, such as 40-degree mini-squats and step-ups.
- May use a Theraband for resistance in hip exercises and mini-squats.
- Start BAPS board exercises.
- Begin lunges (usually 8–10 wk).
- Can use stationary bicycling with affected leg only with added resistance to aid strengthening.
- Because most patients with patellar fractures eventually develop some degree of chondromalacia, emphasize that restoration of quadriceps strength is essential to assist in the absorption of body weight load that is transmitted up the kinetic chain.
- The exercise program should emphasize restoration of lower extremity strength and flexibility. After this is achieved, implement a maintenance program with emphasis on closed-chain exercises. All exercises should be in a pain-free ROM.
- Evaluate the entire lower extremity, especially for excessive pronation of the feet, which add stresses to the knee and exacerbate patellofemoral-type symptoms. Use orthotics if excessive pronation is noted.

Table 5: Rehabilitation protocol for nonoperative patella fracture (26)

Rehabilitation Protocol
Postoperative Patellar Fracture after Open Reduction and Internal Fixation
(Continued)
S. Brent Brotzman, MD

ion) is helpful for timing of postoperative ROM progression. Document the degrees of flexion reached intraoperatively with good stability of construct and give to the therapist.

Postoperative Days 1–7

- Weight-bearing as tolerated with crutches or walker with long-leg straight-leg cylinder cast or commercial full-length knee brace locked in extension (0 degrees.) Brace may be unlocked during ambulation at approximately 3 wk if good quadriceps control.
- Maximal elevation + ice for 3–5 days.
- Gentle quad sets, SLR if surgeon feels construct is very stable.
- Use heel elevation for *contralateral* shoe to help ground clearance of involved straight-leg cast during ambulation.

Weeks 2–6

- Begin gentle patellar mobilization exercises, the patient should become independent in this exercise.
- Electrical muscle stimulation for quadriceps reeducation.
- Stationary bicycling with seat elevated and no resistance. Begin at 5–6 wk.

Week 6

- Ensure radiographic evidence of healed fracture.
- Progress isometric exercises with 1- to 2-pound weights on thigh for SLR.
- Stool scoots.
- Increase bicycling distance, speed, and endurance.
- Begin gentle closed-chain exercises
  - 30-degree mini-squats.
  - Wall sits.
  - Stool scoots.
  - Lateral step-ups (4-inch platform).
- Hamstring curls with 2–5 pounds at ankle.
- We employ a hinged brace until the patient reaches 90 degrees of flexion and has excellent quadriceps control.

Table 6: Rehabilitation protocol for postoperative patellar fracture after open reduction and internal fixation (26)

3.Special Part(Case Study)

3.1 Methodology

This case study was conducted on Mr. T.P during the last 2 weeks of January 2012 to first week of February 2012 in total 3 weeks. The patient came to the physiotherapy department of Ústřední Vojenská Nemocnice (UVN) with a closed fracture of the Right Patella (ICD-10 S82.0). The process of the therapy started with initial kinesiological examination followed by 6 therapy sessions and a final kinesiological examination. During the examinations and therapies I was allowed to use the equipment in the clinic including:

- Therapy table
- Measurement tape
- Neurological hammer
- Goniometer
- Overball
- Various sized pillows
- Balance boards of different shapes

With these equipments, different types of therapy were used including manual methods, PIR and soft tissue techniques by Lewit as well as other types of strengthening exercises.

My study was supervised by physiotherapist Martina Puchmertlova, and my patient was fully informed about the process from the beginning, and the work has been approved by the Ethics Committee of the Faculty of Physical Education and Sport, Charles University, Prague.

3.2 Anamnesis

Name of the patient: T.P
Date of Birth: 01.06.1977

Diagnosis:
Closed fracture of the Right Patella S82.0 (ICD-10)

Chief Complaints:
Patient complains about limited mobility, lack of power in right lower extremity and pain during walking.

History of present problem:
Patient went to hospital 25.11.2011 with knee pain. During a football game he collided with a person from the other team. The patient was the defender and he collided with the attacker from the other team. Collision was knee on knee. Patient did not receive surgical treatment, only conservative.

Present State:

Height : 184 cm
Weight**:** 84 Kg
BMI: 22,2
It has now been 8 weeks since the incident.

Psychosocial History

Work:
Head nurse of Psychiatry Department in UVN Ústřední Vojenská Nemocnice

in *Prague 6*

Hobbies:

Patient plays football, tennis, squash, and other types of sports when he has the chance. Very active person, but the activity level has gone to only physiotherapy 3 times a week.

Living Conditions:

Patient lives in a 1.floor apartment with no stairs and good accessibility to his apartment.

Family:

Has a wife and two children

Personal and Medical History:

Diseases:

None

Operations:

The patient had a ankle surgery when he was 15-16 years old.

Medications:

None

Abuses:

Cigarettes – None smoker

Alcohol – Occasionally

Drugs – The patients does not use any form for drugs

Previous Rehab:

The patient did not have any rehabilitation for any other diseases.

Indications for rehabilitation:

Patient took off the cast and was send for rehabilitation by doctor.

Differential considerations:

Patient's complaint of lack of mobility can be caused by shortened biceps femoris and quadriceps femoris on left leg also shortened and hypertonic biceps femoris on right leg. This will cause hypertonicity of the leg adductors on right leg. Furthermore restriction of soft tissues around the leg and mobility of patella should be visible.
Lack of power can be muscle atrophy caused by patients cast on his leg.

3.3 Initial Kinesiological Examination

Postural Examination:

Anterior View:

- Patient has normal base
- Medial and longitudinal arches are normal
- Lateral rotation in ankle joint, right ankle joint is rotated more laterally than left ankle joint
- Tibial lateral rotation
- Genu Varum
- Right patella is higher than left
- SIAS are in physiological line

Lateral View:

- Hyperextension of left knee
- Physiological tilt of the SIAS and SIPS
- Slight lordosis on the lumbar spine
- Flat Thoracic spine

Posterior View:

- Right calcaneas varus
- Left calcaneus straight
- Equal lines of fossa poplitea
- SIPS in physiological line
- Height of iliac crest is normal
- Scapula alata on both sides.
- Patient has bowd legs when asked to put legs together
- Hypertrophy of right paravertal muscles.

Dynamic Spine Examination:

Forward Bend – Patient was 22cm from touching the ground

Backward Bend – Limited mobility of Thoracic Spine

SideBend:

R	L
58cm	55cm

Gait Examination:

Patient was asked to walk inside without shoes. Examination of the patients gait showed patient walks with eversion of both ankle joints. He takes small steps, and loads his left side more. Slight dorsiflexion of ankle joint in both LE. Slight extension of hip joint. Synkinesis of upper extremity is absent

Modification of gait:

On tip toes – No problem

On heels – No problem

Squatting – No problem is muscular strength. Slight problem with balance

Sideways – No problem

ROM Measurements*:

Right Knee Joint*		**Left Knee Joint**	
Active	0°- 2° - 110°	Active	0° - 0° - 110°
Passive	0°- 2° - 120°	Passive	2° - 0° - 125

Table 7: Table of ROM measurement of knee joint during initial examination

Right Hip Joint	**S**	**F**	**T**	**R**
Active	8° - 0 - 95°	30° – 0 – 10°		24° - 0 – 30°
Passive	10° - 0° -108°	30°- 0 – 10°		30°- 0 - 30°

Table 8: Table of ROM measurement of Right Hip Joint during initial examination

Left Hip Joint	**S**	**F**	**T**	**R**
Active	8°- 0 - 108°	45° - 0 – 10°		28° - 0 – 20°
Passive	10°- 0 -110°	45° - 0 –10°		30 – 0 – 20°

Table 9: Table of ROM Measurement of Left Hip Joint during initial examination

Right Ankle Joint	**S**	**F**	**T**	**R**
Active	40° - 0 – 15°			10°- 0 – 30°
Passive	40° - 0 – 15°			10° - 0 – 30°

Table 10: Table of ROM of Right Ankle Joint during initial examination

Left Ankle Joint	**S**	**F**	**T**	**R**
Active	43° - 0 – 17°			10°- 0 – 30°
Passive	45° - 0 – 20°			10° - 0 – 30°

Table 11: Table of ROM Measurement of Left Ankle Joint during initial examination

*SFTR method used

Anthropometric examination:

Circumference of:	Right Lower Extremity	Left Lower Extremity
Thigh (10cm above patella)	44cm	46
Thigh (15cm above patella)	46cm	49,5
Calf	37,5cm	39cm
Knee	39,5	39

Table 12: Table of Anthropometric examination, circumference of lower extremity during initial examination

Length of:	Right Lower Extremity	Left Lower Extremity
Whole Lower Extremity (Anatomical Length)	86cm	86cm
Whole Lower Extremity (Functional Length)	95cm	95cm
Thigh	44cm	44cm
Middle leg (Tibia)	36,5cm	36cm

Table 13: Table of Anthropometric measurement, length of lower extremity during initial examination

Strength test* of lower extremity:

Muscle Tested:	*Right Lower Extremity*	*Left Lower Extremity*
Gluteus Maximus	4-	4-
Gluteus Medius	4	4+
Gluteus Minimus	4	4+
Hip Flexors (Psoas Major,Psoas Minor, Iliacus)	4	4
Hip Adductors (Adductor Longus,Brevis,Magnus)	4	4
Tensor Fascia Latae	4	4
Sartorius	4+	4+
Quadriceps (Vastus Lateralis, Medialis, Intermedius, Rectus Femoris)	3+	4
Hip Lateral Rotators (Piriformis,Gemellus Superior and Inferior, Obturator Internus and Externus)	4-	4-
Biceps Femoris	4	4-
Semimembranosus and Semitendinosus	4	4+
Soleus	4+	4+
Peroneus Longus	3+	4-
Peroneus Brevis	3+	4-
Tibialis Posterior	4	4
Tibialis Anterior	4	4

Table 14: Table of Strength test result of lower extremity during initial examination

*Test done according to Kendall

Palpation of muscle tone:

Muscle Palpated	*Right Lower Extremity*	*Left Lower Extremity*
Gluteus Maximus	Eutone	Hypotone
Gluteus Medius	Eutone	Eutone
Hip Flexors (Psoas Major,Psoas Minor, Iliacus)	Hypertone	Hypertone
Hip Adductors (Adductor Longus,Brevis,Magnus)	Hypertone	Eutone
Tensor Fascia Latae	Eutone	Hypertone
Sartorius	Hyper	Eutone
Vastus Lateralis,	Hyper	Eutone
Rectus Femoris	Hyper	Hyper
Piriformis	Hyper	Hyper
Biceps Femoris	Hyper	Hyper
Semimembranosus and Semitendinosus	Hyper	Hyper
Soleus	Hyper	Hyper
Tibialis Posterior	Hyper	Eutone
Tibialis Anterior	Eutone	Eutone
Lumbar Erector Spinae	Hyper	Hyper

Table 15: Table of muscle tone results during initial examination

*Test done according to Kendall

Shortness of Muscles*:

Muscle Tested:	*Right Lower Extremity*	*Left Lower Extremity*
Ilipasoas	Yes	yes
Rectus Femoris	Yes	Yes
Tensor Fascia Latae	No	Yes
Gastrocnemius	Yes	Yes
Soleus	Yes	No
Piriformis	Yes	Yes
Biceps Femoris	Yes	Yes
Semimembranosus and Semitendinosus	Yes	Yes
Hip Adductors (Adductor Magnus,Longus,Brevis)	No	No
Quadratus Lumborum	No	No

Table 16: Table of muscle shortness results during initial examination

*Test done according to Kendall

Examination Of Joint Play:**

Tested Area	Right Lower Extremity	Left Lower Extremity
Patella	Restriction to all direction	No restriction
Sacroiliac joint in Posterior Direction	No restriction	No restriction
Sacroiliac Joint in Anterior direction	No restriction	No restriction
Knee joint in Lateral direction	Restricted	Restricted
Knee joint in Medial direction	Restricted	Restricted

Knee Joint in Anterior direction	Restricted	Restricted
Knee Joint in Posterior direction	Restricted	Restricted
Head of Fibula	Restricted in dorsal and ventral directions	Restricted in dorsal direction
Navicularis	No restriction	No Restriction
Calcaneus	No restriction	No Restriction
Talocrural Joint	No restriction	No restriction
Listfrank Joint	No restriction in all directions	No restriction in all directions
Distal Phalang	Restriction of Big toe in cranial direction	No restriction in all directions
Proximal Phalangs	No restrictions	No restrictions
Metatarsophalangial Joint	No restrictions	No restrictions

Table 17: Table of Joint play results during initial examination

**Examination done by Lewit

Scale Test:

Right	Left
35Kg	40Kg

Neurological Examinations:

Romberg's Test – Negative (Only done as orientational)

Subjective Light Touch – Normal sensation

Deep tendon reflexes:

Patellar Reflex – 2

Ankle Reflex – 2

Plantar Reflex – 2

Conclusion of examination:

The initial kinesiological examination shows the patient has both muscular and structural restrictions. Tightness of muscles surrounding the knee joint, mainly rectus femoris, biceps femoris, semimembranosus and tendinosus was shown by muscle length test. The structural restrictions around the knee joint, mainly restriction of patellar movement, was shown by joint play examination as well as postural examination that showed valgosity of knee joint on both sides. Muscle strength test shows loss of strength of muscles around knee and ankle joint, main muscles being quadriceps muscles for knee and for ankle peroneus longus and brevis. Gait examination and scale test indicates the same. ROM examination shows he has limited ROM in knee flexion and extension of hip joint.

3.4 Short and Long term Rehabilitation

Short-term rehabilitation plan:

Short term plan will be to relax hypertonic muscles, stretch shortened muscles and gain muscle strength and ROM in knee and hip joint as well as remove the blockage on patella.

Long-term rehabilitation plan:

Long term plan will be to maintain strength and stability in knee joint.

3.5 Therapy Process

Day to Day Therapy:

Date: 20.01.2012

Patient seems rested and happy. He seems excited to begin his treatment. Complains about some pain in his knee.

Joint play examination:

Restricted movement of right LE patella to all directions.

Therapy applied by patella mobilization to cranial, caudal, medial and lateral direction by Lewitt (20)

Test for shortness of Rectus Femoris, Iliopsoas and TFL by Kendall (16). Found shortness in Rectus and Ilipasoas

Therapy applied, PIR by Lewitt (20) to the shortened muscles. It was applied with patient supine with the treated leg out hanging from the side.

Strength training:

Exercise 1:

Patient is supine with a pillow under his knee. He is doing isometric contraction of the quadriceps muscle by imagining pushing down the pillow. This exercise was performed 2 x 10 with 1 second contractions.

Exercise 2:

Training with Overball. Overball is filled with 30 % air. Patient is lying supine with overball under his knee and he is pushing the ball down without lifting his heel from the bed. Performed 2 x 10

Exercise 3:

Training with Overball. Position is the same as exercise 2, this time the patient is lifting his ankle up from the table and lifting up his toes. He keeps the position for 2-3 seconds and relaxes. Performed 2 x 7. Stopped on 7 because the patient was tired.

Exercise 4:

Training with Overball. Patient is lying supine with his knees bent. The overball is places between patient's knees and he performs adduction by pushing knees toward the ball. Performed 2 x 10

Self Therapy:

Isometric contractions of the quadriceps muscle 2x10 every day

Post-therapy examination:

Decrease shortness of hip flexors

Day to Day Therapy:

Date: 25.01.2012

Joint play examination:

Restricted movement of right LE patella to all directions.

Therapy applied by patella mobilization to cranial, caudal, medial and lateral direction by Lewitt (20)

Test for shortness of Rectus Femoris, Iliopsoas and TFL by Kendall (16). Found shortness in Rectus femoris and Iliopsoas

Therapy applied, PIR by Lewitt (20) to the shortened muscles. Patient is supine in bed with the treated leg hanging out from the side.

Strength training:

Exercise 1:

Patient is supine with a pillow under his knee. He is doing isometric contractions of the quadriceps muscle by imagining pushing down the pillow. This exercise was performed 2 x 10 with 1 second contractions.

Exercise 2:

Training with Overball. Overball is filled with 30% air. Patient is lying supine with overball under his knee and he is pushing the ball down without lifting his heel from the bed. Performed 2 x 10. Training of quadriceps muscle

Exercise 3:

Training with Overball. Position is the same as exercise 2, this time the patient is lifting his ankle up from the table and lifting up his toes. He keeps the position for 2-3 seconds and relaxes. Performed 2 x 10

Exercise 4:

Training with Overball. Overball is filled with 50% air. Patient is lying supine with his knees bent. The overball is places between patient's knees and he performs adduction by pushing knees toward the ball. Performed 2 x 10. Training of hip adductors

Exercise 5:

Training with overball. The patient is supine with knees flexed about 70°. The overball is placed in the area of Achilles ligament, a bit caudally. Then the patient slowly straightens his foot, rolling the ball and comes back to starting position. Functional training of quadriceps femoris and biceps femoris, semitendinosus and membranous. Performed 2x10

Post-therapy Examination:

Slight improvement of patella mobility

Self Therapy:

Isometric contraction of quadriceps 2x10 every day

Patella mobilization in caudal, cranial, medial and lateral directions

Day to Day Therapy:

Date: 27.01.2012

Joint play examination: Restricted movement of right LE patella to all directions except medial direction.

Therapy applied by patella mobilization to cranial, caudal, and lateral direction by Lewitt (20)

Joint Play examination: Head of fibula in both LE. Better mobility of left fibula in both directions compared to right side.

Therapy applied mobilization to ventral and dorsal direction by Lewitt (20)

Test for shortness of Rectus Femoris, Iliopsoas and TFL by Kendall (16). Found shortness in Rectus and Ilipasoas

Therapy applied, PIR by Lewitt (20) to the shortened muscles. Patient supine on table with treated leg hanging out from the side.

Palpation: of musculus Bicep femoris, semitendinosus and semimembranosus. Found hypertonicity on both LE.
Therapy applied, PIR by Lewitt to all muscles examined. With patient supine in bed.

Strength Training:

Exercise 1:

Training with Overball. Overball is filled with 30% air. Patient is lying supine with overball under his knee and he is pushing the ball down without lifting his heel from the bed. Strength training for quadriceps muscle. Performed 2 x 10

Exercise 2:

Training with Overball. Position is the same as exercise 2, this time the patient is lifting his ankle up from the table and lifting up his toes. He keeps the position for 2-3 seconds and relaxes. Strength training for quadriceps. Performed 2 x 10

Exercise 3:

Training with overball.Overball is filled with 50 % air. The patient is supine with knees flexed about 70°. The overball is placed in the area of Achilles ligament, a bit caudally. Then the patient slowly straightens his foot, rolling the ball and comes back to starting position. Functional training of muscles quadriceps, biceps femoris, semitendinosus and membranosus.
Performed 2x10

Exercise 4:

Training with Overball. Overball is filled with 50% air. Patient is lying supine with his knees bent. The overball is places between patient's knees and he performs adduction by pushing knees toward the ball. Strength training for hip adductors. Performed 2 x 10

Exercise 5:

Breaking exercise. Patient is sitting on the edge of the table. He extends the knee to full extension. The therapist is then putting pressure towards flexion as the patient is to slowly go towards flexion, breaking the pressure. Patient is told to be able to stop my

pressure at any time. This is also done towards extension.
Performed 1x10. Patient was very tired after one round

Exercise 6:

Patient is prone. Patient does flexion and extension in knee joint and the therapist gives resistance in both directions. Training of knee flexor and extensors
Performed 2x10

Post-therapy examination:

Better mobility of patella towards lateral and medial side and slight improvement of mobility in caudal and cranial directions.
Decreased hypertone of hamstrings

Self Therapy:

Patella mobilization in caudal, cranial, medial and lateral directions

Day to Day Therapy:

Date: 30.01.2012

Patient feeling happy. Feels improvement of his knee and feels he put more weight on right leg.

Joint play examination: Better mobility compared to last therapy. The patient has been doing self therapy for mobility. Improved in all directions except caudal
Therapy applied: patella mobilization of right LE in caudal, cranial, medial and lateral directions by Lewitt (20)

Joint play examination: Head of fibula on right LE. Restricted in dorsal and ventral directions
Therapy applied mobilization in both direction by Lewitt (20)

Test for shortness of Rectus Femoris, Iliopsoas and TFL by Kendall. (16) Found shortness in Rectus and Ilipasoas
Therapy applied PIR by Lewitt to the shortened muscles. Patient supine on bed with treated leg hanging out from the side.

Palpation: of musculus Bicep femoris, semitendinosus and semimembranosus. Found hypertonicity on both LE.
Therapy applied PIR by Lewitt to all muscles examined. Performed with patient supine on the table.

Length test of quadriceps by Kendall (16): Found shortness in right LE
Therapy: Dynamic stretching in prone position.

Strength Training:

Exercise 1:

Making bridge: Patient is supine with knees bent at 70° of flexion. Hands along the side of the body, the patient lift pelvis up and keep the position for 3 seconds. Strength training for mainly gluteal muscles and hamstrings.
Performed 2x10

Exercise 2:

Training with overball. Overball is filled with 50% air. The patient is supine with knees flexed about 70°. The overball is placed in the area of Achilles ligament, a bit caudally. Then the patient slowly straightens his foot, rolling the ball and comes back to starting position. Functional training of quadriceps and hamstrings for knee stability.
Performed 2x10

Exercise 3:

Training with overball. Patient is supine with knees flexed and the overball between knees. The patient first makes a bridge as in exercise 2, and then extends right knee. Goes slowly back to starting position. This is done on both sides. Main aim being quadriceps muscle, this also includes gluteal muscles, hamstrings and also rectus abdominis and transversus
Performed 1x10 Patient was tired after one round.

Exercise 4:

Breaking exercise. Patient is sitting on the edge of the table. He extends the knee to full extension. The therapist is then putting pressure towards flexion as the patient is to slowly go towards flexion, breaking the pressure. Patient is told to be able to stop my

pressure at any time. This is also done towards extension.
Performed 2x10

Exercise 5:

Training on rocker board. Patient is on rocker board with both legs. With small flexion in knee joint, he is rocking slowly forward and backwards. Keeping the posture and the flexion in knee same at all times.

Post-therapy examination:

The mobility of patella to caudal direction is the same. Slight improvement to cranial, medial and lateral from last therapy session.
Improvement of quadriceps shortness\knee flexion.
Slight improvement of head of fibula mobility.

Self therapy:

PIR against gravity for hamstrings
Make bridge 2x10 every day

Day to Day Therapy:

Date: 03.02.2012

Patient was complaining about pain on lateral side of right knee.

Joint play examination: Patella mobility. Restricted to all directions, mostly caudal on right knee
Therapy applied: patella mobilization to caudal, cranial, medial and latereal direction by Lewitt (20)

Joint play examination: Head of fibula on right LE. Restricted in dorsal and ventral directions
Therapy applied mobilization in both directions by Lewitt (20)

Muscle length: Length test done for biceps femoris, semitendinosus, semimembranosus gastrocnemius and soleus Found shortness on gastrocnemius and soleus

Palpation: Biceps femoris, semitendinosus, semimembranosus and gastrocnemius. Found trigger points on gastrocnemius

Therapy applied: PIR with stretching for gastrocnemius muscle by Lewit. (20) Performed with patient supine on table.

Soft tissue Examination: Examination of deep fascia and skin around calf muscles on LE. Found restricted movement of deep fascia on right LE to medial and lateral directions.
Therapy applied by fascia stretch to restricted directions.

Strength Training:

Exercise 1:

Making bridge: Patient is supine with knees bent at 70° of flexion. Hands along the side of the body, the patient lift pelvis up and keep the position for 3 seconds. Training strength of gluteal muscles and hamstrings. Performed 2x10

Exercise 2:

Training with overball. Patient is supine with knees flexed and the overball between knees. The patient first makes a bridge as in exercise 2, and then extends right knee. Goes slowly back to starting position. This is done on both sides. Main aim being quadriceps muscle and knee stability, this also includes gluteal muscles, hamstrings and also rectus abdominis and transversus. Performed 2x10

Exercise 3:

Training with exercise ball. Patient is doing squats with exercise ball against the wall. Ball is placed between the patient back and wall. Patient goes slowly down and up. Strengthening of quadriceps, hamstrings, gluteal muscles.
Performed 2x10

Exercise 4:

Training on rocker board. Patient is on rocker board with both legs. With small flexion in knee joint, he is rocking slowly forward and backwards. Keeping the posture and the flexion in knee same at all times. Training of knee stability

Exercise 5:

Training on wobble board. Patient is on wobble board with both legs. With small flexion in knee joint, he is rocking side to side. Keeping the posture same at all times. Training of balance

Exercise 6:

Training on wobble board. Patient is on wobble board with both legs. With small flexion in knee joint, he is making circles. Keeping the posture same at all times. Training of balance and knee stability

Post Therapy Examination.

Better mobility of head of fibula in both directions.

No shortness of gastrocnemius and soleus

Slight improvement of patella in all directions

Self Therapy:

Patient is told to continue with patella movement and also making bridge 2x10every day.

Day to Day Therapy:

Date:08.02.2012

Joint play examination: Patella mobility of right knee. Restricted to all directions, mostly caudal

Therapy applied: mobilization to caudal, cranial, medial and lateral directions by Lewitt (20)

Joint play examination: Head of fibula on right LE. Restricted in dorsal and ventral directions

Therapy applied mobilization in both directions by Lewitt (20)

Strength Training:

Exercise 1:

Training with overball. Patient is supine with knees flexed and the overball between knees. The patient first makes a bridge, and then extends right knee. Goes slowly back to starting position. Main aim being quadriceps muscle and knee stability, this also includes gluteal muscles, hamstrings and also rectus abdominis and transversus This is done on both sides. Performed 2x10

Exercise 2:

Training with exercise ball. Patient is doing squats with exercise ball against the wall. Ball is placed between the patient back and wall. Patient goes slowly down and up. Strengthening of quadriceps, hamstrings, gluteal muscles. Performed 2x10

Exercise 3:

Sensomotoric exercises. Forward lunge exercise. Strengthening of quadriceps muscles Performed 10 times

Exercise 4:

Training on wobble board. Patient is on wobble board with both legs. With small flexion in knee joint, he is rocking side to side and up and down. Keeping the posture same at all times. Balance and stability training of knee joint.

Exercise 5:

Training on wobble board. Patient is on wobble board with one leg at the time. With small flexion in knee joint, he is trying to maintain balance. Training of knee stability

Exercise 6:

Sensomotoric exercises. Step exercise with both LE on a wobble board (half ball) Performed 10 times

3.6 Final kinesiological examination:

Anterior View:

- Patient has normal base
- Medial and longitudinal arches are normal
- Lateral rotation in ankle joint, right ankle is rotated more laterally than left ankle
- Tibial lateral rotation
- Genu Varum
- Patella's are aligned
- SIAS are in physiological line

Lateral View:

- Hyperextension of left knee
- Physiological tilt of the SIAS and SIPS
- Slight lordosis on the lumbar spine
- Flat Thoracic spine

Posterior View:

- Right calcaneas varus
- Left calcaneus straight
- Equal lines of fossa poplitea
- SIPS in physiological line
- Height of iliac crest is normal
- Scapula alata on both sides.
- Patient has bowed legs when asked to put legs together
- Hypertrophy of right paravertal muscles.

Dynamic Spine Examination**:**

Forward Bend – Patient was 21cm from touching the ground

Backward Bend – Limited mobility of Thoracic Spine

Side Bend:

R	L
52cm	52cm

Gait Examination**:**

Final gait examination was performed under the same circumstances as initial examination. Patient was asked to walked indoor without shoes. Patient showed he still walks with eversion in both ankle joints. He has good step-length and loads each side of leg equally during midstance period on both sides. There is improvement of knee and hip extension on both sides, but dorsiflexion of ankle joint is limited. Also synkinesis of UE is still absent

Modification of gait:

Squatting – No problem

ROM Measurements*:

Right Knee Joint*		**Left Knee Joint**	
Active	0°- 2° - 118°	Active	0° - 0° - 120°
Passive	0°- 2° - 120°	Passive	2° - 0° - 125

Table 18: Table of ROM measurement of knee joint during final examination

Right Hip Joint	**S**	**F**	**T**	**R**
Active	8° - 0 - 100°	30° – 0 – 10°		24° - 0 – 30°
Passive	10° - 0° -108°	30°- 0 – 10°		30°- 0 - 30°

Table 19: Table of ROM measurement of Right Hip Joint during final examination

Left Hip Joint	**S**	**F**	**T**	**R**
Active	8°- 0 - 110°	45° - 0 – 10°		28° - 0 – 20°
Passive	10°- 0 -120°	45° - 0 –10°		30 – 0 – 20°

Table 20: Table of ROM Measurement of Left Hip Joint during final examination

Right Ankle Joint	**S**	**F**	**T**	**R**
Active	40° - 0 – 15°			10°- 0 – 30°
Passive	40° - 0 – 15°			10° - 0 – 30°

Table 21: Table of ROM of Right Ankle Joint during final examination

Left Ankle Joint	**S**	**F**	**T**	**R**
	43° - 0 – 17°			10°- 0 – 30°
Passive	45° - 0 – 20°			10° - 0 – 30°

Table 22: Table of ROM Measurement of Left Ankle Joint during final examination

*SFTR method used

Anthropometric examination:

Circumference of:	Right Lower Extremity	Left Lower Extremity
Thigh (10cm above patella)	43,5cm	45.5
Thigh (15cm above patella)	47cm	49
Calf	38cm	39cm
Knee	39	39

Table 23: Table of Anthropometric examination, circumference of lower extremity during final examination

Length of:	Right Lower Extremity	Left Lower Extremity
Whole Lower Extremity (Anatomical Length)	86cm	86cm
Whole Lower Extremity (Functional Length)	95cm	95cm
Thigh	44cm	44cm
Middle leg (Tibia)	36,5cm	36cm

Table 24: Table of Anthropometric measurement, length of lower extremity during final examination

Strength test* of lower extremity:

Muscle Tested:	*Right Lower Extremity*	*Left Lower Extremity*
Gluteus Maximus	4	4
Gluteus Medius	4	4+
Gluteus Minimus	4	4+
Hip Flexors (Psoas Major,Psoas Minor, Iliacus)	4	4
Hip Adductors (Adductor Longus,Brevis,Magnus)	4	4
Tensor Fascia Latae	4	4
Sartorius	4+	4+
Quadriceps (Vastus Lateralis, Medialis, Intermedius, Rectus Femoris)	4	4+
Hip Lateral Rotators (Piriformis,Gemellus Superior and Inferior, Obturator Internus and Externus)	4+	4+
Biceps Femoris	4	4
Semimembranosus and Semitendinosus	4	4+
Soleus	4+	4+
Peroneus Longus	4	4
Peroneus Brevis	3+	4
Tibialis Posterior	4	4
Tibialis Anterior	4	4

Table 25: Table of Strength test result of lower extremity during final examination

*Test done according to Kendall

Palpation of muscle tone:

Muscle Palpated	*Right Lower Extremity*	*Left Lower Extremity*
Gluteus Maximus	Eutone	Hypotone
Gluteus Medius	Eutone	Eutone
Hip Flexors (Psoas Major,Psoas Minor, Iliacus)	Hypertone	Hypertone
Hip Adductors (Adductor Longus,Brevis,Magnus)	Hypertone	Eutone
Tensor Fascia Latae	Eutone	Hypertone
Sartorius	Eutone	Eutone
Vastus Lateralis,	Eutone	Eutone
Rectus Femoris	Eutone	Hyper
Piriformis	Hyper	Hyper
Biceps Femoris	Eutone	Eutone
Semimembranosus and Semitendinosus	Eutone	Eutone
Soleus	Eutone	Eutone
Tibialis Posterior	Hyper	Eutone
Tibialis Anterior	Eutone	Eutone
Lumbar Erector Spinae	Hyper	Hyper

Table 26: Table of muscle tone results during final examination

*Test done according to Kendall

Shortness of Muscles*:

Muscle Tested:	*Right Lower Extremity*	*Left Lower Extremity*
Ilipasoas	Yes	yes
Rectus Femoris	Yes	No
Tensor Fascia Latae	No	No
Gastrocnemius	No	No
Soleus	No	No
Piriformis	Yes	Yes
Biceps Femoris	Yes	No
Semimembranosus and Semitendinosus	Yes	No
Hip Adductors (Adductor Magnus,Longus,Brevis)	No	No
Quadratus Lumborum	No	No

Table 27: Table of muscle shortness results during final examination

*Test done according to Kendall

Examination Of Joint Play:**

Tested Area	Right Lower Extremity	Left Lower Extremity
Patella	Improved mobility, most restriction to caudal direction	No restriction
Sacroiliac joint in Posterior Direction	No restriction	No restriction
Sacroiliac Joint in Anterior direction	No restriction	No restriction
Knee joint in Lateral direction	Restricted	Restricted
Knee joint in Medial direction	Restricted	Restricted
Knee Joint in Anterior direction	Slight Restriction	Slight Restriction
Knee Joint in Posterior direction	Restricted	Restricted
Head of Fibula	Restricted in dorsal	Restricted in dorsal direction
Navicularis	No restriction	No Restriction
Calcaneus	No restriction	No Restriction
Talocrural Joint	No restriction	No restriction
Listfrank Joint	No restriction in all directions	No restriction in all directions
Distal Phalang	No restrictions	No restrictions
Proximal Phalangs	No restrictions	No restrictions
Metatarsophalangial Joint	No restrictions	No restrictions

Table 28: Table of Joint play results during final examination

**Examination done by Lewit

Scale Test:

Right	Left
37Kg	40Kg

3.6.1 Final Kinesiological Examination Conclusion:

The final kinesiological was performed 8. February 2012 and shows the patients improvement to the therapy applied. The patient came for physiotherapy for lack of muscular strength and limited mobility in the affected area. The final examination shows patients improvement in muscular strength, mobility and muscle shortness after 6 therapy sessions.

There is increased strength of quadriceps femoris on the right leg, better mobility of right patella. There is still some shortness of biceps femoris, semimembranosus and semitendinosus on right side, as well has hip adductors of right leg.

There is big improvement in ROM of both hip and knee joints. Most noticeable being flexion of right knee by 10°.

Even though he has improved, he has still not reached full mobility in patella.

3.7 Evaluation Of Effect Therapy

This patient came to us with a fracture on his right patella. After careful examination we begin the short term therapy to improve his complaints. My main concern was to strengthen the weak quadriceps muscles and regain patella movement as well as making sure the hypertonic muscles did not cause any pain.
If we look at the melioration of the patient comparing the first kinesiological examination to the last we can see that the improvement in different values.

- Great improvement in range of motion in both hip and knee joints. The improvement around 10° of flexion in knee joints and 5° of flexion in hip joint.
- Better mobility of patella and in all directions. But there was still some restriction in caudal direction.
- Reaching eutone in hypertonic muscles using PIR as the primary technique.
- Strengthening weak muscles, mostly quadriceps femoris and the lateral rotators of hip.

The improvement of patella mobility was a coordinated achievement by the therapist doing mobilization in every direction as well as teaching the patient how to do it himself at home for faster healing.
For relaxation of muscles and also improving ROM using PIR was the best choice in the. It was also a method that could be thought to the patient, giving him the choice of doing it at home when not in therapy.

Strengthening part of the treatment was done by isometric contraction to begin with and slowly go towards dynamic exercises. I noticed the patient's strength increased rapidly after we started with dynamic type of exercises.

All in all I believe that the therapy was successful towards the goal that we set, but only having 6 therapy sessions was not enough to reach certain goals like reaching full mobility of patella. With further therapy I think that is possible

4. Conclusion

Working at Ústřední Vojenská Nemocnice gave me a lot of experience on caring for different type of patients with different etiologies. I got to use the type of therapies learned at FTVS as well as new type thought by my supervisor. For me it was very important to use the skills I have acquired during my studies to improve them further. Having different patient's everyday gave me the challenge to use my skills on different etiologies.

Choosing my patient was collaboration with my supervisor. We wanted a patient who was just starting his\her therapy, could speak English and also had interesting case. Most important part was for me to perform the therapy from the beginning to be able to see the progress. After one week into my practice my patient presented himself with patella fracture he obtained during a football match. He had pain and problems with stability.

I approached the patient with a rehabilitation plan similar to how the clinic treats the patients. The patient's ability to speak and understand was very good for me, because communication is very important between patient and therapist.

During the 6 sessions I had with my patients we both could see the improvement from day 1 until our last session together. Treating this type of injury was a very good experience for me.

During the course of the therapy there was availability of hydrotherapy as well as electrotherapy, but I decided to keep it simple and spend most time with my patient in therapy room. The treatment in my opinion was very effective. He improved greatly during the course of 6 sessions. The rapid improvement came after functional training with balance board and half stability ball.

None the less, having only 6 therapy session was not enough time to reach our goals for the long term rehabilitation. But with more functional training I believe that he will reach his goals.

Also I am very happy to have worked besides talented physiotherapist who thought me new ways to approach different injuries and I will take this with me for rest of my studies as well as professional life.

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6. Supplement

6.1 Informed consent

INFORMOVANÝ SOUHLAS

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

Dnešního dne jsem byla odborným pracovníkem poučena o plánovaném vyšetření a následné terapii. Prohlašuji a svým dále uvedeným vlastnoručním podpisem potvrzuji, že odborný pracovník, který mi poskytl poučení, mi osobně vysvětlil vše, co je obsahem tohoto písemného informovaného souhlasu, a měla jsem možnost klást mu otázky, na které mi řádně odpověděl.
Prohlašuji, že jsem shora uvedenému poučení plně porozuměla a výslovně souhlasím s provedením vyšetření a následnou terapií.
Souhlasím s nahlížením níže jmenované osoby do mé dokumentace a s uveřejněním výsledků terapie v rámci studie.

Datum: 20.01.2012

Osoba, která provedla poučení: PUCHMELTZOVÁ MARTINA

Podpis osoby, která provedla poučení: Puchmeltzová Martina

Vlastnoruční podpis pacienta /tky:

6.2 X-Ray Pictures


RDG ORT FN B
kV 57
mAs 10.0
L-R R
W 4096
C 2048
RDG ORT FN
kV 60
mAs 8.0
A-P R
W 4096
C 2048


RDG-ORT-1
kV 57
mAs 10.0
L-R R
W 4096
C 2048


RDG-OR-
kV 60
mAs 8.0
A-P R
W 4096
C 2048


RDG ORT NN
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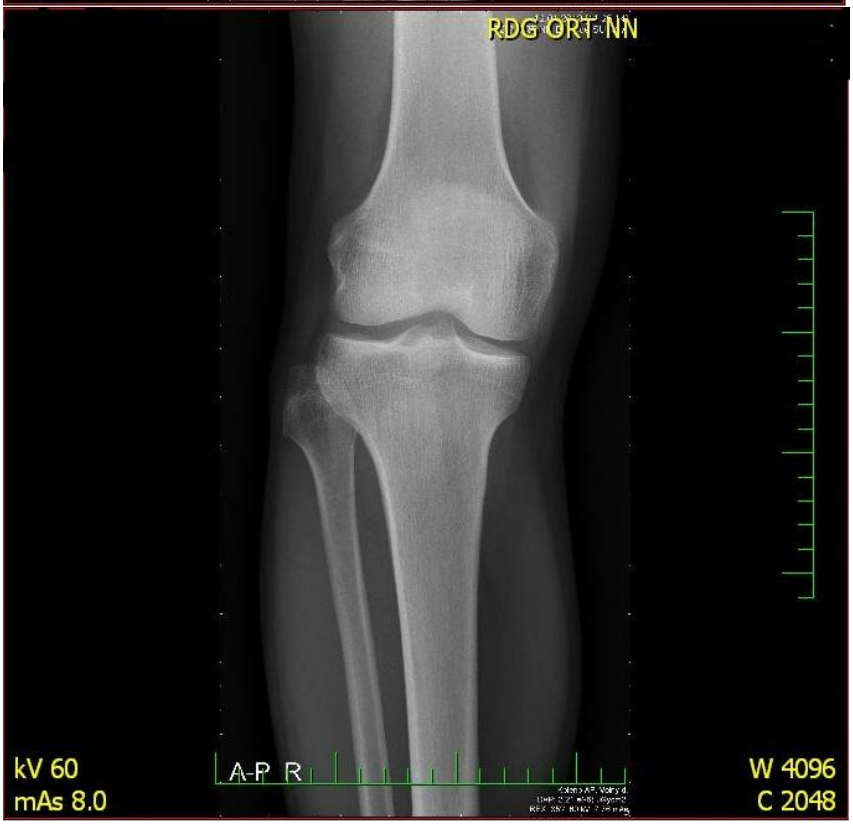
mAs 10.0
L-R R
W 4096
C 2048


RDG ORT NN
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6.3 List Of Tables

6.4 List of Figures

6.5 List of abbreviations

ACL = Anterior cruciate ligament
AIIS = Anterior Inferior Iliac Spine
ASIS = Anterior Superior Iliac Spine
FCL = Fibular Collateral Ligament
FTVS = Fakulta Telesne Vychovya a Sportu
LE = Lower Extremity
OTA = Orthopaedic Trauma Association
TCL = Tibial Collateral Ligament
TF = Tibiofemoral Joint
PCL = Posterior cruciate ligament
ROM = Range of Motion
UE = Upper Extremity

6.6 Approval Of the Ethics Board Committee