CHARLES UNIVERSITY IN PRAGUE

FACULTY OF PHYSICAL EDUCATION AND SPORT

DEPARTMENT OF PHYSIOTHERAPY

BACHELOR DEGREE OF PHYSIOTHERAPY

BACHELOR THESIS

PHYSIOTHERAPEUTIC TREATMENT OF A PATIENT WITH DIAGNOSIS OF ANKLE SPRAIN

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Abstract

Title: Physiotherapeutic treatment of a patient with ankle sprain

Author: Christoforos Koupparis

Location of clinical work placement: C.L.P.A (Centrum léčby pohybového aparátu)

Aim

The aim is a further understanding of an anterior talofibular ligament sprain. Generally in my thesis you can see how the structure of an ankle joint is and the function of the same joint by a kinesiological and a biomechanical point of view. Furthermore it will be described in details a therapy plan about that diagnosis.

Summary

My bachelor thesis contains two main parts, the general part and the special part. In the general part I analyze the branches of anatomy, kinesiology and biomechanics for the ankle joint. In this part you can find also an overview of the ankle sprain and the physiotherapy examinations that need to be done in such situations. On the other hand, the special part is an extended report of my case study. There are included kinesiological examinations (initial-final) and the rehabilitation program that I followed day by day with my patient during my clinical work placement. At the end there are the final results and a conclusion

Results

The results of my case study were positive and this is deduced from the final outcome of my patient. At an early stage of the rehabilitation program, the patient had pain and swelling relief. By the end of the therapy sessions we managed to increase the ROM in the physiological levels, we resolved the joint play restrictions and the hypertonic muscles got relaxed. Strengthening of both lower limb muscles was a main goal that also achieved. Finally we fixed the bad stabilization of the ankle joint and the patient's posture became significantly balanced.

Key words: ankle sprain, anterior talofibular ligament, soft tissue techniques, joint play mobilization, post isometric relaxation, sensomotoric training.

Acknowledgment

First of all, I would like to thank my family for their endless courage and support that they offered me during my studies. In some difficult moments they motivate me to get over my struggles and to become stronger and more decisive. Without them I could not start and keep up my studies.

In some occasions, that my family couldn't help me because of the distance, my close friends were there for me ready to face together my problems and I feel grateful for them.

Finally, I would like to thank all of my professors for the knowledge and the help that they offered me during my studies in Charles University. Moreover, special thanks goes to my supervisor Mgr. Michaela Stupková and my instructor Mgr. Zaher El Ali for their valuable help and guidance of writing my bachelor thesis.

Declaration

I would like to declare that my bachelor thesis has been written by me from my own case study that took place at the C.L.P.A clinic from 4.01.2016 until 15.01.2016.

Also I want to state that my patient was fully aware about the examination and the therapy procedures that he undergo during my clinical work placement. You can find the approval form, signed by my patient, at the end of my thesis.

Christoforos Koupparis
Prague, October 2016

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1. Preface (Introduction)

My clinical work placement took place at the C.L.P.A clinic under the supervision of Mgr. Zaher El Ali. My practice held for two weeks starting from the 14th of January 2016 and finishing on the 15th of the same month/year.

The patient, which I had for my bachelor thesis, was diagnosed by an ankle sprain of the anterior talofibular ligament on his left side. The injury happened on the 22nd of December 2015 during a basketball game.

My bachelor thesis consists of two main parts. The 1st part (general part) describes mainly the theory around the ankle joint. This part is focused on the structure, function and biomechanics of the joint. Continuing, you can see an overview of the ankle sprain and the physiotherapy examinations to be made.

The 2nd part (special part) includes principally my clinical work practice about a patient with anterior talofibular ligament sprain. In this part are analyzed the initial and final examinations that I used and also the therapy sessions, day to day, that we had.

Concerning the initial examinations we put a proper rehabilitation plan that was followed and at the end of the therapy we proceeded to the final examinations, from where the results came.

Finally, each reader of my bachelor thesis should be able to comprehend the basic principles of an ankle sprain and the importance of a right approach in such diagnosis.

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2. General Part

2.1. Anatomy of the ankle joint

The ankle is the place where the leg meets with the foot. This meeting creates three main separate joints which are the:

- Talocrural (or proper ankle joint) is a uniaxial hinge joint created by the distal parts of the tibia and fibula which are attached on the proximal part of talus. This joint can perform the movements of plantar flexion and dorsal flexion.
- Inferior tibiofibular is a powerful joint created between the distal parts of the tibia and fibula. There is no any special movement done by this joint.
- Subtalar is a joint connecting the talus and the calcaneus. The joint can perform the movements of inversion and eversion. Moreover it works as a shock absorber whenever is needed. [22, 24,26]

2.1.1. Bones of the ankle joint

The proper ankle joint is made up by 3 bones:

- The shin bone called tibia. Tibia is stronger than the other two bones and is connecting the knee with the ankle. At the distal part of the tibia there is a significant protuberance called medial malleolus.
- The thick bone that is parallel to the tibia, at the lateral side, is called fibula. At the distal part of this bone there is also a significant protuberance called lateral malleolus.
- The foot bone which is located under the tibia and the fibula and above the heel bone (calcaneus) is called talus. [24,23]

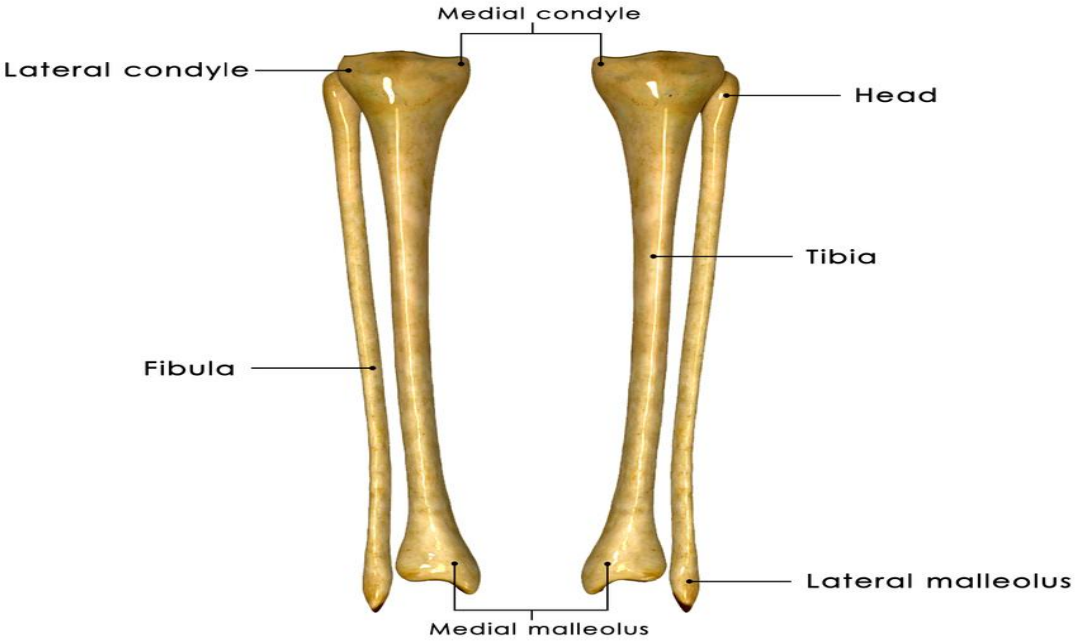

Figure 1: The bones of tibia and fibula – anterior view [24]

Figure 2: The bones of foot – superior view [26]

2.1.3. Ligaments of the ankle joint

Generally a ligament is a flexible and strong fibrous tissue, which connects a bone with another bone. The capsule of the ankle joint is posteriorly and anteriorly weak, but medially and laterally is enforced with four collateral ligaments. On the medial side is located the deltoid ligament and on the lateral side are located the calcaneofibular ligament, the anterior talofibular ligament and the posterior talofibular ligament. These four collateral ligaments have crucial role for the stability of the ankle itself and are written below based on where they attach: [21]

- Deltoid ligament: connects the medial malleolus with the a) posterior part of talus, b) sustentaculum tali of calcaneus, c) mavicular bone and d) anterior part of talus
- Calcaneofibular ligament: connects the calcaneus with the fibula
- Anterior talofibular ligament: connects the lateral malleolus with the anterior part of talus
- Posterior talofibular ligament: connects the lateral malleolus with the posterior part of talus [23]

Even though the lateral side consists of three collateral ligaments is weaker than the medial side which consists just from one collateral ligament. The biggest mechanical forces applied to the ankle joint, during walking and running, are directing to the medial side. This results to a greater thickness and strength of the deltoid ligament. [21]

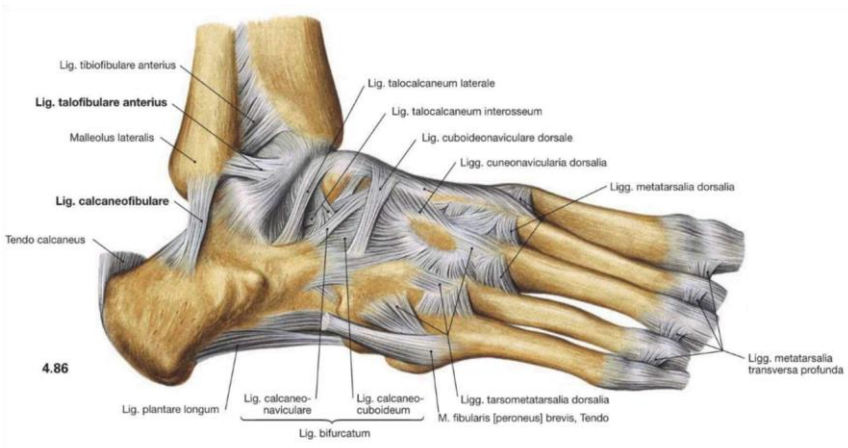

Figure 3: The ligaments of ankle joint – lateral view [25]

2.1.4. Muscles of the ankle joint

The movements that can be performed from an ankle joint are plantar flexion, dorsal flexion, inversion and eversion. In order to facilitate these ankle movements, muscles of the lower leg insert into ankle and foot bones. These muscles can be split into anterior, posterior and lateral compartments. [22]

The posterior compartment muscles are mainly responsible for plantar flexion, inversion of the foot and flexion of the toes. This group is divided into superficial and deep layer muscles. The anterior compartment muscles are mainly responsible for dorsal flexion of the foot and the lateral compartment muscles are responsible for plantar flexion as well as eversion of the foot. [22, 23]

Anterior compartment muscles	Origin	Insertion	Action	Innervation
Tibialis anterior	Lateral condyle and body of tibia and interosseous membrane	First metatarsal and first cuneiform.	Dorsal flexion and inversion of the foot	Deep fibular nerve.
Extensor halluces longus	Anterior surface of middle third of fibula and interosseous membrane.	Distal phalanx of great toe.	Dorsal flexion of the foot and extends proximal phalanx of great toe.	Deep fibular nerve.
Extensor digitorum longus	Lateral condyle of tibia anterior surface of fibula and interosseous membrane.	Middle and distal phalanges of toes 2-5	Dorsal flexion of the foot and extends distal and middle phalanges of each toe.	Deep fibular nerve.
Peroneus tertius	Distal third of fibula and interosseous membrane	Base of fifth metatarsal	Dorsal flexion and eversion of the foot	Deep fibular nerve.

Table 1: Group of muscles in the anterior compartment of lower leg [22]

Posterior compartment muscles (superficial)	Origin	Insertion	Action	Innervation
Gastrocnemius	Lateral/medial condyles of femur and capsule of knee	Posterior surface of calcaneus	Plantar flexion of the foot and flexion of the knee joint	Tibial nerve
Soleus	Head and fibula and medial border of tibia	Posterior surface of calcaneus	Plantar flexion of the foot	Tibial nerve
Plantaris	Lateral epicondyle of femur	Posterior surface of calcaneus	Plantar flexion of the foot and flexion of the knee joint	Tibial nerve

Table 2: Group of superficial muscles in the posterior compartment of lower leg [22]

Posterior compartment muscles (deep)	Origin	Insertion	Action	Innervation
Tibialis posterior	Proximal tibia, fibula and interosseous membrane.	Second, third and fourth metatarsals, navicular and all three cuneiforms.	Plantar flexion and inversion of the foot	Tibial nerve
Flexor digitorum longus	Middle third of posterior surface of tibia	Distal phalanges of toes 2-5	Plantar flexion of the foot, flexes the distal and the middle proximal phalanx of each toe.	Tibial nerve
Flexor halluces longus	Inferior two-thirds of posterior portion of fibula.	Distal phalanx of great toe	Plantar flexion of the foot, flexes the distal and proximal phalanx of each toe.	Tibial nerve

Table 3: Group of deep muscles in the posterior compartment of lower leg [22]

Lateral compartment muscles	Origin	Insertion	Action	Innervation
Peroneus longus	Head and body of fibula	First metatarsal and first cuneiform	Plantar flexion and eversion of the foot.	Superficial fibular nerve.
Peroneus brevis	Distal half of body of fibula	Base of the fifth metatarsal	Plantar flexion and eversion of the foot.	Superficial fibular nerve.

Table 4: Group of muscles in the lateral compartment of lower leg [22]

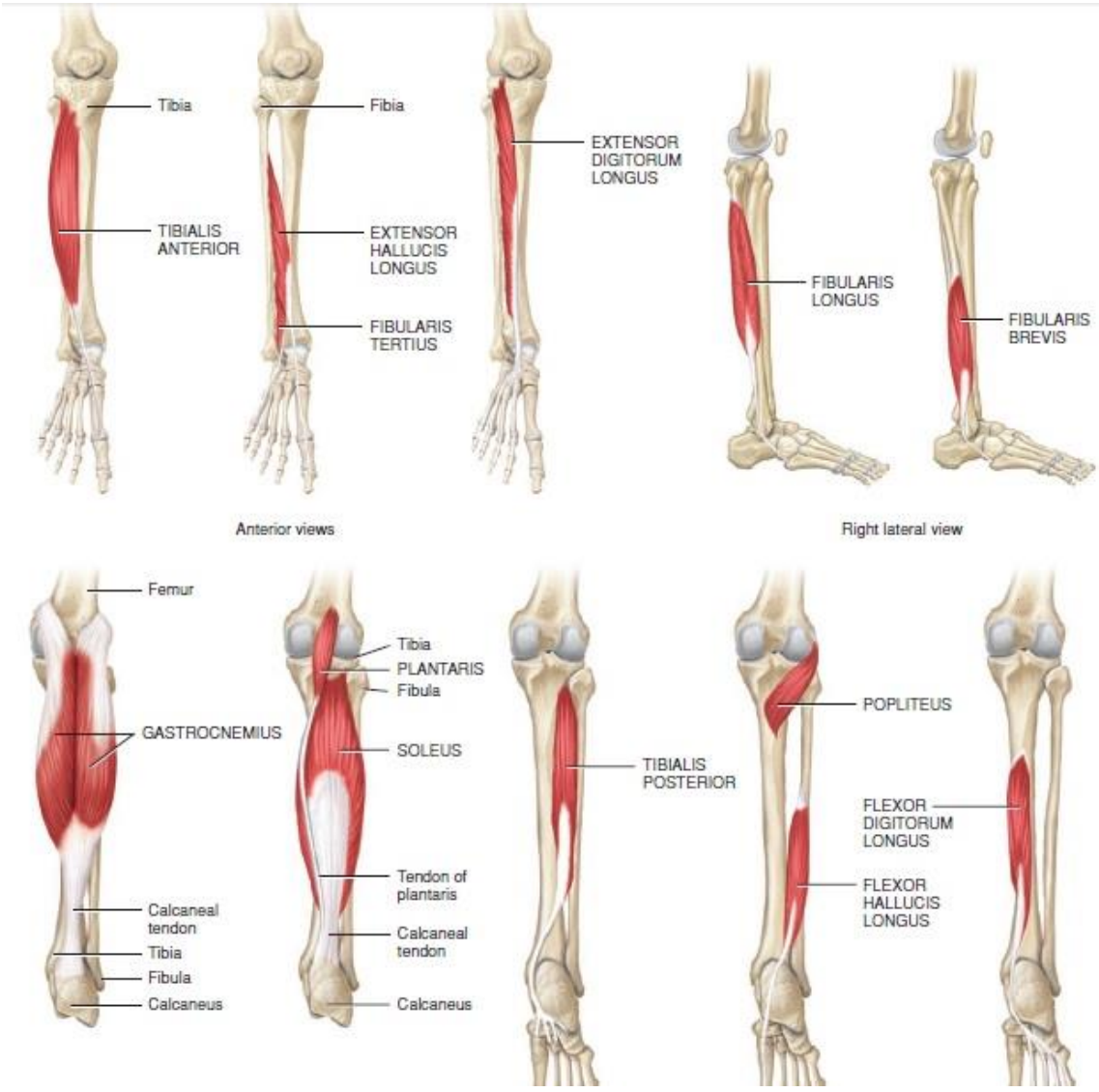

Figure 4: The responsible muscles for movement of the ankle joint [25]

2.1.5. Innervation concerning the ankle joint

The nerves, like the muscles, are split into three compartments. The anterior compartment is associated with the deep fibular nerve. This nerve starts from the branch of the common peroneal nerve, passing through the intermuscular septa by taking an anteromedial direction and finishes at the anterior part of the lower leg in order to supply it. [23,26]

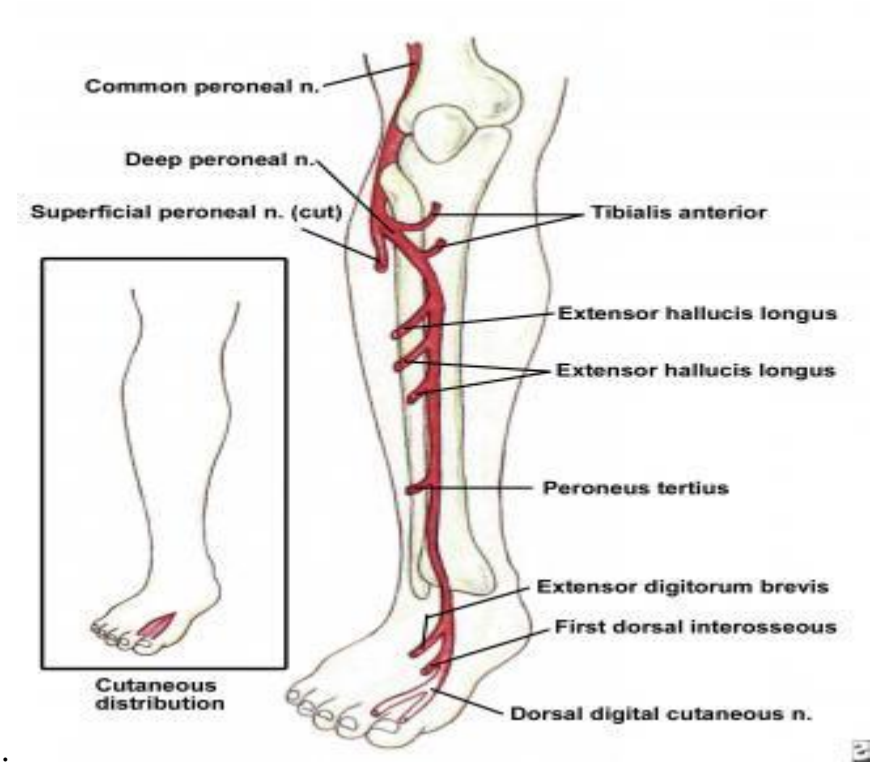

Figure 5: Innervation of the deep fibular nerve [10]

In the other hand, the posterior compartment is associated with the tibial nerve which is a branch of sciatic nerve. It courses down the posterior thigh and from popliteal fossa it continues to the posterior part of the lower leg. Except from the muscles that were mentioned before, it supplies the plantar surface of the foot. [24, 25]

Finally, the last nerve is associated with the lateral part of the lower leg is the superficial fibular nerve which originates from one of the biggest branches of the common fibular nerve. Like the tibial nerve, the superficial fibular nerve finds its way to the lateral part of the lower leg from the popliteal fossa. It also originates from the sciatic nerve as the tibial nerve. [26]

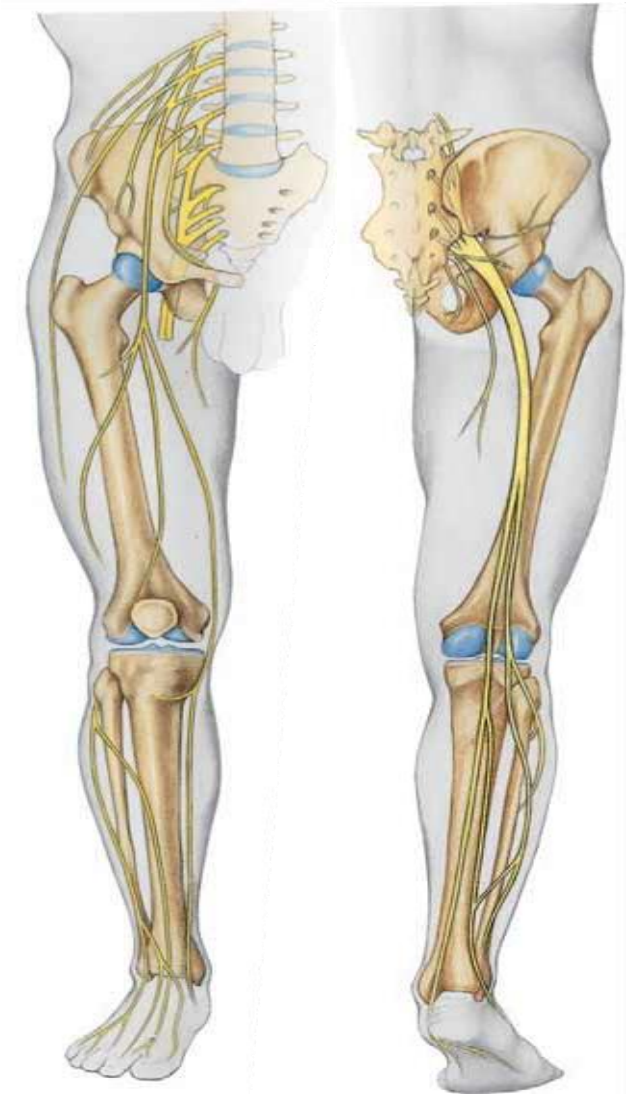

Figure 6: Innervation on the anterior and posterior compartment of the lower leg [9]

2.1.6. Blood supply related to ankle

The popliteal artery, deeply continued from the femoral artery, is the biggest blood supplier of the leg and foot. Coming from the posterior side of the leg, through the popliteal fossa, enters the deep region and ends at the lower part of the popliteus muscle. There it splits into the anterior tibial arteries and posterior tibial arteries. [22, 23]

The anterior tibial artery carries blood for the anterior compartment of the leg. On the continuation of this artery we have two big branches which both passes posteriorly around the tibia and fibula, on their distal ends. These branches are the anterior medial and lateral malleolar arteries. [23, 26]

On the other hand posterior and lateral compartments are supplied by the posterior tibial artery. This artery has also two big branches, the circumflex fibular artery and the fibular artery. The first one passes through the soleus muscle on the lateral side and the second one is heading along the lateral side of the posterior compartment.

Moreover the posterior tibial artery along with the dorsalis pedis artery carry blood for the region of foot. The dorsalis pedis is the continuation of the anterior tibial artery and supplies specifically the dorsal surface of the foot. At the proximal part of the first intermetatarsal space where the dorsalis pedis terminates, we have a connection of the lateral plantar artery with deep plantar arch. The deep plantar arch branches carry the blood for the toes. Now, concerning the veins that we didn’t speak about they generally follow the same path of the arteries. [23, 24, 26]

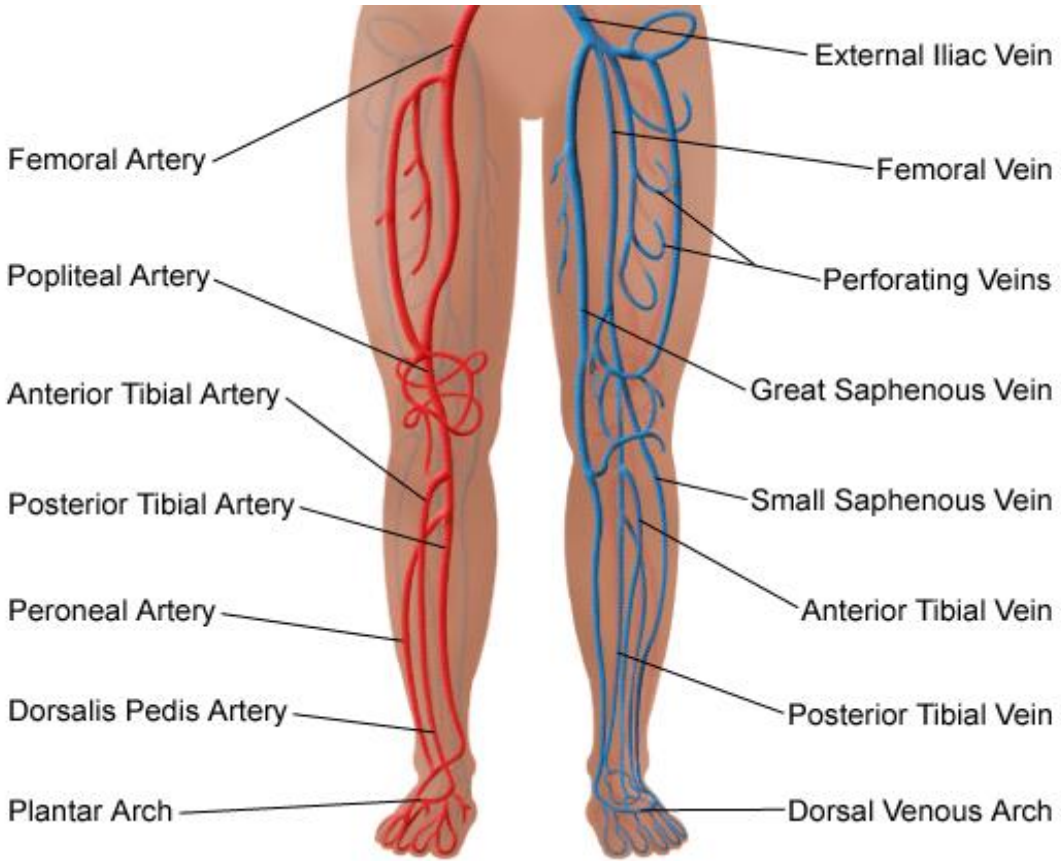

Figure 7: Arteries and veins – anterior view [9]

2.2. Kinesiology of ankle joint

Anatomically if we divide the foot there will be three different segments. These segments will be formed by the two lines of the Chopart and Lisfranc joints. The segments presented as follow:

1. Hindfoot: formed by talus and calcaneus
2. Midfoot: formed by the cuboid, navicular and the three cuneiforms (medial, intermediate and lateral)
3. Forefoot: formed by the five metatarsal bones and the five phalanges of toes

By this division of the lower leg and foot we have an increased motion at the place where the Chopart joint is. [2, 5]

Moreover if we observe the foot from a superior angle there is another one division that is significant. The division is made from two parallel rays:

1. Medial ray: consists of the talus, navicular, three cuneiforms, 1^{st} – 3^{rd} metatarsal and 1^{st} – 3^{rd} phalanges of toes
2. Lateral ray: consists of the calcaneus, cuboid, 4^{th} - 5^{th} metatarsal and 4^{th} – 5^{th} phalanges of toes [7]

According to this division, the small toe is primarily pressured by the cuboid and calcaneus and secondary by the talus that rests above the calcaneus. At the distal part of the foot is created torsion and both rays align in the forefoot segment. Due to these facts, the talus and calcaneus move different while loading and the subtalar joint controls the ROM in the Chopart joint. [13]

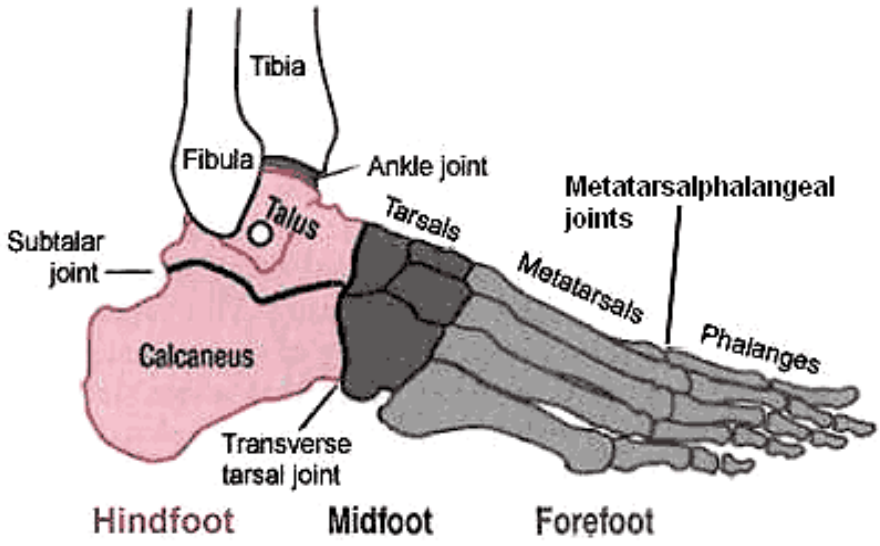

Figure 8: The three segments of foot divided by Chopart and Lisfranc joints [ ]

2.2.1. Arches of the foot

The skeleton of the foot is designed with a longitudinal arch and a transversal arch. Their function is to protect the soft tissue of the foot and allow the foot to be

flexible. From a biomechanical point of view these arches absorb and divide the downward forces created by the whole body during standing and walking. [8]

The longitudinal arch of the foot starts from the posterior end of calcaneus and ends at the heads of the metatarsal bones. The tibial side of this arch is higher in contrast with the fibular side which is lower. Its skeleton is supported by ligaments which are found longitudinally lengthwise the plantar side of foot and also by muscles along the sole of foot (tibialis posterior, flexor digitorum longus, flexor hallucis longus and superficial short plantar muscles). It can be easily noticeable from the medial side of the foot. [5, 1]

The transverse arch is more prominent at the places of the cuneiform and the cuboid bones. It adapts according to the position of the two lines presented in the tarsal area at different heights from the ground. This arch is supported by the ligaments of the plantar side as well from the anterior tibialis and peroneus longus muscles. [6]

2.3. Biomechanics of ankle joint

Speaking about the ankle we refer to three different joints: the talocrural joint (or proper ankle joint), inferior tibiofibular joint and the talocalcaneal joint, often called the subtalar joint. [6]

Proper ankle joint is mainly responsible for dorsal flexion and plantar flexion, whereas subtalar joint is mainly responsible for inversion and eversion. The inferior tibiofibular joint is not responsible for any basic movement. Internal and external rotations are equally allocated to both ankle and subtalar joints. Inversion and internal rotation are strongly connected together and poorly connected to plantar flexion. The same applies with the couple of eversion and external rotation against the dorsiflexion.

According to these, with a forceful rotation to any of these two axes (plantar flexion, dorsal flexion) there will induce rotation on the strongly connected couples without any limit. However, in most cases an injury will appear when the movement of foot in relation with the leg is limited and not physiological. [6, 7]

Figure 9: True ankle joint – Subtalar joint [9]

2.3.1. Loads on the foot

In accordance to Newton's third law when a body weight and speed increases the impact force of the same body increases too. This law fits perfectly during jumping, running or even walking and the impact force act to the object that contacts the ground. The force applied from the ground to the foot is a reaction force followed by the force of the foot that hit the ground. [6]

The structures of the foot are anatomically designed so as during the weight bearing the load is equally distributed over the foot. Approximately 50% of the total body weight is distributed through the subtalar joint to the calcaneus and the remaining 50% transmitted across the metatarsal heads. The first metatarsal head supports twice the load carried by each of the other metatarsal heads.

Sometimes the architecture of the foot influences the loading pattern. A relatively flat arch condition tends to decrease the force of reaction from the ground on the forefoot, with relatively high arch significantly increases the same force on the forefoot. [8, 7]

2.3.2. Anomalies of the foot alignment

Varus and valgus are specific conditions (inward and outward lateral deviation, respectively, of a body segment) that can be occurred in all the major parts of the lower extremity. They can occur from birth or may appear from a muscle's strength imbalance.

In the area of foot, it can be affected the rearfoot, the forefoot, and the toes. Rearfoot varus and valgus cause inversion and eversion misalignments at the subtalar joint while forefoot varus and valgus refer to misalignments of inversion and eversion to the metatarsals. Hallux valgus refers to a lateral deviation of the big toe and is usually caused to women who wear shoes with pointed toes. [7]

Varus and valgus affecting the femur and the tibia can change the kinematics and kinetics of their joint movement. This can happen because in such situation it cause extra stress on the stretched side of the joint being affect. For example, if we have a situation with tibial valgus with femoral varus the result will be extra stress to the medial part of the knee. In contrast, the opposite situation of tibial varus and femoral valgus adds more tension on the lateral part of the knee.

According the cause of the misalignment change, procedures are provided in order to correct it. Some of the procedures can be: a) strengthening exercises b) stretching of specific muscles and ligaments c) using of orthotics (special designed inserts which can be worn inside the shoe to give support to a specific area). [7, 8]

2.3.3. Common disorders of foot

During the cycle phase in gait, the flexibility or rigidity behavior of the foot is determined from pronation and supination. The time which the foot contacts the floor, we firstly have a simultaneous pronation with eversion of calcaneus, then adduction and plantar flexion of talus while supination results from the opposite movement of calcaneus inversion.

Most common foot disorders are consider to be the flat-foot, tendonitis, plantar fasciitis, neuromascular disorders and metatarsalgia. [8]

2.4. Ankle sprain

Ankle sprain, known also as ankle twist, ankle distortion, floppy ankle and rolled ankle, is a common injury when one or more of the ankle ligaments has a partial or a complete tear.

Sometimes ankle sprain is confused with the ankle strain which is total different condition. Ankle strain is a painful situation caused by inflammation, overuse or unbalance of the ankle joint. This medical condition affects muscles and tendons such as the Achilles tendon.

On the other hand an ankle sprain is often caused when one of the joints in ankle area is forced on a motion that is outside of its usual range of movement. During such a motion the ligaments get over stretched and it can easily lead to partial or complete torn of the ligaments that were more affected. [3, 4]

2.4.1. Grades of ankle sprains

An ankle sprain can range from mild to severe and this depends on how much damage there is to the affected ligaments. After such an injury patients should visit an orthopedic doctor for examinations. These examinations will show the severity of the injury and the doctor will determine the grade of the sprain that can be as follow:

- Grade 1 (mild sprain): there is a microscopic tearing and slight stretching of the ligament fibers. Symptoms can be swelling and mild tenderness over the ankle.
- Grade 2 (moderate sprain): resulting in a partial tear of the affected ligament and symptoms will show moderate swelling and tenderness on the area.
- Grade 3 (severe sprain): in this type of ankle sprain there is total tear of one or more ligaments and like the previous grades the patient will also face the symptoms of tenderness and swelling but in a more significant level.

The clinician must take a careful evaluation of an ankle sprain to show if there is present any fracture of a bone. The examinations of the doctor giving a grade of the severity to an ankle sprain will benefit to a later stage the rehabilitation. The grading help the physiotherapist to put up a proper therapy plan. [4, 5, 17]

2.4.2. Epidemiology

In general, an ankle sprain is one of the most common musculoskeletal injuries. A lot of these injuries (Grade 1 most probable) are probably self-treated and never reported to a health care provider. For that reason many of the ankle sprains were never documented. Ankle sprains represents 10-15 % of all sports injuries and studies showed that female athletes are 25% more likely than male athletes to suffer from this kind of injury. Most cases were reported during a basketball game and less in other sport activities. Soccer and volleyball are the following sports on the list that reported high number of incidents. Ankle sprain used to be called a minor injury but, according to many studies, months or couple of years after the injury, a high percentage of patients show come back symptoms and repeated ankle sprains. [2, 15]

Ankle injuries are very common in athletes, with the majority of the cases, around 80% to be ankle sprain. From this statistic of ankle sprains, the vast majority (85%) affects the lateral part of the ankle and more likely the anterior talofibular ligament. [3, 5, 14]

2.4.3. Clinical picture - symptoms

The clinical picture of an ankle sprain is not always the same and on each patient it might slightly differs depending on the severe of the trauma and the grade of the injury. Most likely the symptoms after ankle injury can be:

- swelling
- tenderness
- bruising
- pain
- inability to put weight on the affected ankle
- skin discoloration
- stiffness [12, 13]

2.4.4. Conservative therapy of acute sprain

Ankle sprain can be treated with conservative therapy but the treatment shouldn't last more than three days. The main goals of the treatment is to minimize the swelling, control or even decrease the pain and maintain the ROM. The treatment should follow the rule of ''RICE'' (rest – ice – compression – elevation) or even better the ''PRICES'' rule (protection – rest – ice – compression – elevation – support) [3]

Protection - Depending on the grade of the ankle sprain devices like air splints or plastic and Velcro braces can be used for the duration of 4-21 days. Devices like this more often are instructed by the doctor after the patient's diagnosis. Ankle sprains more likely of the 1st grade can be treated without casting.

Rest – Following of an ankle sprain, the importance of the rest is to promote tissue healing. The patient should avoid ADL activities that cause increased pain and swelling. If the patient wears a brace should also remove it sometimes to provide pain-free movements in all directions. Easy exercises like writing the alphabet or numbers with the foot should be done several times per day.

Ice – Is used to decrease swelling, pain and muscle spasm. The icepack should be followed by a towel around it during the use. Recommendation use to the patient is 15-20 minutes for 3 times every day.

Compression - ACE wrap, elastic ankle sleeve or a lace-up can be used for compression at the affected. This is recommended for the edema and the need to decrease it but the wraps must not applied too tightly in any case.

Elevation - The injured ankle should be elevated above the level of the heart whenever it is possible. The reason for this is to facilitate the relief of swelling.

Support - Include taping or the use of lace-up ankle supports. Supporting the ankle will help to stabilize the area and help the tissue healing. [3, 5, 12]

2.4.5. Prevention

After the healing of an ankle sprain, a new chapter should follow, this of the prevention. The importance of prevention for all patients is big but certainly for those who are athletes is bigger. Certain sports like soccer, basketball and volleyball have a high incidence of ankle sprains. [10]

Athletes should be able to understand how important is the adequate training and conditioning to prevent a further injury to the future. When the rehabilitation program of the athlete end should after gradually switch back into the sport. Before any activity he has to follow a good warm-up stage and during sport should be careful. The athlete shoes must be at a good quality with stability and for increasing the proprioception of the food would be good to train on uneven surfaces. Braces at the ankle and taping could and should be used during the activities for offering a better stability to the athlete. Studies showed that muscle unbalance and increased body weight puts an athlete at a higher risk of ankle sprain. Concerning that the athlete should exercise in a right way with strengthening the whole muscle system and maintaining in a good overall condition. [3]

2.4.6. Examination procedures by the physician

The physician examinations is very important to be performed before to any kind of therapy. The examination will differentiate an ankle sprain from a fracture. Observing at the beginning for any hematoma, joint deformation and swelling it is critical. Later on the physician procced to a palpation examination to find out which structures are affected from the injury. Movement in all directions follows, first actively and then passively, to find out the level of the restrictions in ROM. Neurologic assessment of the injured area will be done by the neurologic hammer for reflexes and for the sensation can be used a sharp thing. Moreover, a series of special tests will be provided by the physician before instructing the patient to undergo the imaging methods of x-ray and MRI. These special test are: [4, 2, 6]

- Talar tilt
- Anterior Drawer
- External rotation (Kleiger's test)
- Thompson's test
- Compression test. [4]

2.5. Physiotherapists examinations

The physiotherapists are important to follow the protocol examinations. This results the receiving of information, which will allow them to set a right rehabilitation plan for the progress of the patient's therapy.

2.5.1. Anamnesis

The medical history of the patient is very important as it will give us information about the history of the patient. The physical therapist, especially during this examination, must be friendly so that the environment will be pleasant. This will help the patient to be more open for discussion and the physiotherapist will collect as much information he/she can, from patient's past, which will help him/her later on evaluating the problem.

Furthermore the therapist should observe during the examination the patient's body language and attitude.

2.5.2. Posture examination

The main goal of the posture examination is to examine the whole structure of the patient's body. The examination is performed in three different views. The anterior or front view, the posterior or back view and the lateral-side view from both sides. In the beginning of the examination is asked from the patient to take off his/her clothes (except the underwear) and to stand near the plumb line. The plumb line is placed on the middle of the patient's body in order the therapist to observe any asymmetries between the two sides. The posture examination is executed by starting from down to up in each view and it should not take too long in duration. Moreover if the patient has any injury associated with bad weight bearing should be taken into consideration about the final results.

2.5.3. Anthropometric measurements

For the examination of anthropometric measurements the physiotherapist needs a measuring tape. The goal of this examination is to measure the length and the

circumference of the patient's both upper and lower extremities but as well the circumferences of the head, thorax waist and hips. The result will show if there are any differences between the two side's measurements. During the whole examination the patient should be relaxed in order of not changing the muscle's schema of the structures that are being measured.

2.5.4. Mobility of Segment (Dynamic test)

The dynamic test is provided in the movements of flexion, extension and lateral flexion of the trunk. This examination allow the therapist to observe if the movement of the trunk is physiological and if there is any synkinesis or restriction during the motion. The motion in the segments of the spine should be equally distributed. Pain or any other discomfort during the examination should be taken into consideration.

2.5.5. Two scales test

For this test the patient is asked to stand on the two scales, with one leg on each scale, without looking on them. The test is performed 2-3 times and it can show us the difference of loading between the two sides. The two scales test considers to be positive when the difference of the two sides is more than 10% of the total patient's weight.

2.5.6. Special test

The **Vele's test** is a special test which shows to the therapist the stability of the ankle joint. This test has four grades with grade 1 being the physiological and grade 4 considering serious stability disorder.

1) Normal

Toes slightly touch the floor and it is possible to insert a paper between the toes and foot with ease.

2) Slight deviation

Slight posture deficiency, toes are pressed against the floor and paper is difficult to retrieve/insert.

3) Bad alignment

Claw-like positioning, toes are heavily pressed against the floor and paper is impossible to retrieve/insert.

4) Serious stability disorder

Foot posture change, deformity, pathology, claw-like stance.

2.5.7. Gait examination

In this examination the patient takes off his/her clothes (except underwear) and provides walking with different ways: forward, backward, on heels, on toes, ascending, descending and with closed eyes. This examination gives the chance to the therapist to observe any abnormalities and take information about the walking pattern of the patient. During the walking is given attention on the walking rhythm, speed, distance and length of the patient's steps. Moreover the therapist observe the position of the lower limb, the contact of the feet to the floor and movement of pelvis, trunk and arms. Any pain or discomfort during a way of walking should be taken into consideration.

2.5.8. Basic movement patterns

The main concept of this examination is to evaluate the quality of six different movement patterns and the sequence of muscle activation during them. The examination is provided for the movement of hip extension, hip abduction, trunk curl-up, push up, shoulder abduction and head flexion. The basic principles for this examination are, slow movement, the physiotherapist shouldn't correct the movement during the active

performance and no contact with hands should be existed, because contact will facilitate the muscles.

2.5.9. Soft tissue examination

The goal of this examination is the therapist to define if there are any restriction on the skin, sub-skin and fascia. Soft tissue examination is performed by the techniques of hold to relaxation and waving on the affected are and towards the restricted directions.

2.5.10. Range of motion examination

The therapist for this examination uses a special instrument called goniometer and the examination is provided in both active and passive motions. The aim of the range of motion examination is to define whether the motion of a joint is in a physiological level or limited and also to notice any difference between the active and passive motion of the specific joint. In order to define any difference the ROM examination must be provided not only on the affected side but also on the healthy one.

2.5.11. Muscle strength test

Basic principles of the muscle strength examination are as follow: 1) The patient must be placed in a position which allows the therapist for the best fixation. 2) Stabilization of the part which is nearest of the tested part in order that only one muscle will be tested each time and will be avoided any synkinesis corrupting the result. 3) The muscle which is going to be tested must be firstly placed in antigravity position. 4) If the muscle is too weak then it should be placed in a horizontal plane to be tested against gravity. 5) The pressure, applied by the hand of the therapist, should be directly opposite of the muscle's movement that is being tested. 6) The pressure which applied also should be gradual in order of letting the patient be prepared to increase the force that is needed for this grade.

In the findings of a weak muscle the therapist should distinguish the weakness from the restriction of ROM. For this reason, after the muscle testing, we should be also providing the passive movement of the muscles which were found weak. If there is any restriction of that passive movement then our result from muscle strength test is not absolutely reliable.

Robert W. Lovett introduced a muscle strength grading which includes six grades as follow:

- Gone- no movement or any contraction is felt
- Trace- contraction is felt but muscle cannot produce any movement
- Poor- muscle produces movement with the absence of gravity (no function against gravity)
- Fair- can move against gravity
- Good- can move against gravity and also against outside resistance
- Normal- can overpower a greater amount of outside resistance than a muscle graded as Good.

2.5.12. Muscle length test

The purpose of this assessment is to define whether the ROM occurred in the joint is normal, limited or excessive and if this caused by the internal joint structures or by the muscles that crossing the specific joint. Muscle length test are performed in movements that increase the distance between the origin and insertion in order to elongate the muscle in an opposite direction of the muscle's action. The basic principles of this examination are: 1) should maintain in a standard testing position, fixation and direction of movement. 2) therapist must apply constant pressure throughout the whole procedure of each muscle. A grading introduced by Janda consist of 3 grades:

- 0 – no shortness
- 1 – moderate shortness
- 2 – marked shortness

2.5.13. Muscle tone examination

The palpation importance is considerable in the diagnosis of painful structures of the locomotor system and essential for all manipulative techniques. Muscle tone examination should be followed immediately after the inspection.

Primary step in palpation is to place a hand onto the surface of the patient's body and then to collect information about the: warmth, moisture, consistency (rough or smooth surface), mechanical properties (resistance, mobility, stretch capacity) and if the patient feels pain during the palpation. The examination should be provided on both sides in order the therapist to comprehend the difference of the muscle tone.

2.5.14. Joint play examination

The mission of manipulation is to restore the joint play to the joints which are restricted. There are two types of manipulation: mobilization and thrust techniques. Important aspect in manipulation is the correct positioning of the patient and the practitioner, the appropriate fixation and taking up the slack (engaging the barrier). By examining and comparing the joint play movements between the two sides, the therapist is able to distinguish whether there is a blockage or not in the target joint.

2.6. Phases of treatment after ankle sprain

This protocol shows the basic principles of a rehabilitation program addressing to patients after an ankle sprain of 1st and 2nd Grade. Is not recommended to patients of 3rd Grade who most often undergo a surgery. This treatment course was introduced by Dr. Lint at the Rosenberg clinic in U.S.A.

Phase A / weeks 0-1

Modalities and ice for reducing pain and inflammation
Compression wrap for reducing the swelling
Crutches training if instructed
Elevation of the ankle above the level of the heart

Beginning of active ROM in all planes

Stationary bike and swimming pool

Phase B / weeks 1-2

Continuing of modalities for reducing the swelling and controlling the pain

Crutches are removed

Continuing with active ROM adding a light terminal stretch

Beginning of 4-plane ankle TB

Strengthening of the inner foot

Beginning of closed chain exercises (calf raises, toe raises, squads)

Proprioception exercises

Stationary bike, elliptical and treadmill walking

Beginning of water pool jogging to the shallow area

Phase C / weeks 2-3

Continuing of modalities for reducing the swelling

Restoring full ROM in all planes

Continuing with open and closed chain exercises and strengthening of the foot

Proprioception exercises become more difficult

Beginning of straight ground running (no treadmill)

Beginning of lateral mobility work (controlled)

Phase D / weeks 3–6

Continuing of modalities as needed

Continuing with the end range stretch

Strengthening and proprioception becomes more difficult

Advance to sprinting and mobility drills or tape

Exercising with field or court drills for simulation (back to sports)

At the end, patient must display a negative clinical exam and by passing a strength and mobility test with more than 90% efficiency is ready for release [16, 3]

3. Special Part (Case Study)

3.1. Methodology

My clinical practice held for 2 weeks at the clinic C.L.P.A (Centrum léčby pohybového aparátu). The practice started from the 3rd of January 2016 and finished on the 15th of the same month. During that period I had a daily timetable (Monday-Friday), for 8 hours, starting from 8 am until 4 pm.

The supervisor during my clinical practice was Mgr. Zaher El Ali. On the 6th of January, day Wednesday, I was informed by my supervisor about a patient with ankle sprain, of 1st grade, that was going to start his rehabilitation treatment. I found a good opportunity of writing my bachelor thesis about him, as the patient could also speak English, resulting to a better communication. On the same day my patient signed an acquiescence form (informovany souhlas) and after that we begin the initial kinesiology examinations. We had 7 therapeutic sessions together, starting from the 7th of January, and during our last session (15th of January) I performed the final kinesiology examinations.

The rehabilitation treatment took place in the individual rooms of therapy as well at the fitness center of the clinic. For the kinesiology examinations I used some instruments such as goniometer, meter tape, plumb line, neurologic hammer and 2 scales. However for the therapeutic procedures I used mostly instruments from the fitness center like thera-bands, posturomed device, wobble board, soft ball, overball, bosu ball, swiss ball, basketball, thick rope and balance sandals.

Finally, I would like also to mention that my research project has been approved by UK FTVS Ethics Committee under the registration number 118/2016. A copy of the "Application of Approval by UK FTVS Ethics Committee" and "Informovany Souhlas" can be found in my thesis.

3.2. Anamnesis

Patient: T.B, 18 years old, (male)

Diagnosis: Lateral ankle sprain (Left L.E)

Code: S93.492A

3.2.1. Present State

Height: 2.02 m

Weight: 83 kg

BMI: 20.34

Pain level: 1/10 (walking downstairs, standing for long time) in scale from 1(=minimum) to 10(=maximum).

The patient feels slight pain on his ankle during long time walking and walking on stairs. The pain is located mainly on the anterolateral region. As a result of his pain the patient cannot be present at his basketball training sessions.

The patient visited the rehabilitation department because he feels irritations on his left ankle. During a basketball game on 22nd of December he jumped to throw the ball and after, on the landing phase to the ground, the result was to twist his left ankle (dominant foot). As the patient said he had bad stabilization at the time that he was contacting the floor and that was the main cause of the injury. He felt a slight pain but he continued for another 5 minutes till his coach substituted him. After the game, when he went home, he felt a little irritation on his left ankle and he applied ice to the area for 10-15 minutes. The next day he noticed that his ankle got a bit swollen so he visited a doctor for examination. The doctor assessed the patient with the help of x-rays and he concluded that he had an ankle sprain (grade 1). He then placed to the patient's ankle a special brace, for a week, to decrease the movement of the injured ankle in a minimal level. Finally, I would like also to mention that the patient is in a good mood and is looking forward to play basketball again soon.

3.2.2. Personal Anamnesis

The patient didn't have any similar injury in the past.

3.2.3. Family Anamnesis

All family members are healthy.

3.2.4. Operation Anamnesis

None

3.2.5. Medication

None

3.2.6. Allergy Anamnesis

None

3.2.7. Social Anamnesis

He lives in a flat on 3rd floor, with his family. The building has elevator.

3.2.8. Occupation Anamnesis

He is a high school student in third grade.

3.2.9. Hobbies

He plays basketball for 10 years and the last year joined the 1st team. Apart from basketball he likes playing videogames in his free time.

3.2.10. Abuses

He doesn't smoke or drink any alcohol.

3.2.11. Previous Rehabilitation

He didn't have any previous rehabilitation.

3.2.12. Statement from the patient's medical documentation

He had x-rays for his left ankle but I didn't see the documents.

3.2.13. Indication of rehabilitation

Decrease the minor pain and swelling

Improve the ROM of left ankle joint

Strengthening the muscles of both lower extremities

Sensomotoric stimulation exercises for both lower extremities

3.2.14. Differential Diagnosis

The slight pain that the patient sometimes feels causes a limitation of movement to the left ankle joint. It might not be a severe pain but it effects patient's daily activities. The pain probably comes from the overstretched ligaments of the left ankle joint but also some other factors like trigger points and muscle imbalance could be the cause of the pain. Moreover, the brace that it was placed to the patient's ankle for about a week, might

result to muscle weakness and slight muscle atrophy to the injured area. Due to the injury is expected an ankle imbalance that can lead to bad alignment in different parts over the body. Surely we will not be surprised if this causes a general bad stabilization over the whole posture and during the examinations a faulty postural position can be observed.

3.3. Initial Kinesiology Examination

6/01/2016

3.3.1. Posture evaluation in standing

Feet distance	Feet close to each other
Transverse arch	Physiological
Longitudinal arch	Physiological
Knee	Physiological
Pelvis position	Same level
Umbilicus	Physiological
Thoracobrachial triangles	Right one is slightly bigger
Sternum	Middle line
Nipples	Symmetrical
Hands	Symmetrical
Clavicles	Symmetrical
Shoulders	Slight elevation on left side
Head position	Physiological
Weight bearing	More weight bearing on right side

Table 5: Initial postural examination- Anterior view

Ankle joint	Straight line
Knee joint	Straight line
Pelvis position	Slight anteflexion
Lumbar region of spine	Physiological lordosis
Thoracic region of spine	Physiological kyphosis
Shoulder position	Slight protraction of both shoulders
Cervical region of spine	Physiological lordosis
Head position	Slight protraction

Table 6: Initial postural examination- Lateral View (both sides)

Heels position	Symmetrical
Achilles tendon	Prominent on both L.E
Calf	Symmetrical
Popliteal lines	Symmetrical
Subgluteal lines	Symmetrical
Iliac crests	On the same level (by palpation)
Posterior superior iliac spines	Symmetrical
Scapulas	On the same level. Right more prominent
Upper extremities	Slight pronation on both
Shoulders	Slight elevation on left side
Head position	Physiological

Table 7: Initial postural examination- Posterior View

3.3.2. Dynamic test (Mobility of segments)

- Maximal extension: The movement is done without any restriction or pain.
- Lateroflexion: The movement is done, in both sides, without any restriction or pain. The range of motion is little bigger towards the left side.
- Maximal flexion: During maximal flexion the patient can not touch the floor and the distance between his fingers and the ground is 4 cm. Though he does not feel any pain, numbness or dizziness.

3.3.3. Special test

- Vele's test: Negative on both sides
- Rhomberg test: Negative on both sides
- Trendelenburg test: Negative for pelvis elevation on both sides. However during the standing on the injured leg he was a bit unbalanced.

3.3.4. Two scales test

Left	Right
39kg	44kg

Table 8: Initial two scales test

3.3.5. Anthropometric measurement

3.3.5.1. Lower extremities Length – Circumferences

Left		Right
103cm	Anatomical length (ASIS)	103cm
114cm	Functional length (Umbilicus)	114cm
96cm	Length of thigh	96cm
49cm	Length of middle leg	49cm
25cm	Length of foot	25cm
43cm	Circumference of thigh (vastus medialis)	42,5cm
48cm	Circumference of thigh (quatriceps)	47cm
36cm	Circumference of knee	36cm
34cm	Circumference of calf	34cm
27cm	Circumference of ankle	26cm
24cm	Circumference of foot	24cm

Table 9: Initial length and circumferences of lower extremities

3.3.6. Gait examination

3.3.6.1. Forward walking

Step phase: Left step is smaller in distance and faster in speed than the right one

Stance phase: Physiological

Rolling of feet: Physiological

Pelvis rotation: Physiological

Trunk movement: Limited trunk rotation

Movement of the arms: Physiological

3.3.6.2. Backward walking

Step phase: Left step is slightly smaller in distance than the right one, first contact point is with the toes and last point with the heel

Stance phase: Physiological

Rolling of feet: Physiological

Pelvis rotation: Physiological

Trunk movement: Limited trunk rotation

Movement of the arms: Physiological

3.3.6.3. Walking on toes

The patient tried to provide the walking on toes, but he stopped because he feels uncomfortable on the injured area.

3.3.6.4. Walking on heels

The patient is leaning a bit forward during the walking on heels and his posture is little unbalanced.

3.3.7. Examination of basic movement patterns (according to Janda)

Extension of hip joint: Negative on both sides

Movement: The movement was done with the correct sequence of muscles activation. First gluteus maximus then hamstrings, contralateral spinal extensors muscles in lumbar region, ipsilateral spinal extensors muscles in lumbar region, contralateral spinal extensors muscles in thoracolumbar region, ipsilateral spinal extensors muscles in thoracolumbar region and final shoulder girdle muscles.

Abduction of hip joint: Positive on both sides (tensor mechanism)

Movement: The movement was not done with the correct sequence of muscles activation. Instead of a pure abduction, there was involved a slight flexion. There was a primary activation of tensor fascia latae and then gluteus medius and minimus. This compensatory movement was observed in both sides.

Curl up (trunk flexion): Negative on both sides

Movement: The patient didn't have any problem to provide the sitting up position from supine and the motion was smooth.

3.3.8. Range of motion examination (according to Kendall)

Hip Joint					
Right	**Active**	**Left**	**Right**	**Passive**	**Left**
10^0	Extension	10^0	10^0	Extension	10^0
115^0	Flexion	115^0	120^0	Flexion	120^0
35^0	Abduction	35^0	40^0	Abduction	40^0
10^0	Adduction	10^0	10^0	Adduction	10^0
40^0	Internal rotation	40^0	40^0	Internal rotation	40^0
35^0	External rotation	35^0	40^0	External rotation	40^0

Table 10: Initial examination of ROM in Hip joint

Knee Joint					
Right	**Active**	**Left**	**Right**	**Passive**	**Left**
-	**Knee joint**	-	-	**Knee joint**	-
0^0	Extension	0^0	0^0	Extension	0^0
125^0	Flexion	120^0	130^0	Flexion	130^0

Table 11: Initial examination of ROM in Knee joint

Ankle Joint					
Right	**Active**	**Left**	**Right**	**Passive**	**Left**
40^0	Plantar flexion	30^0	45^0	Plantar flexion	35^0
20^0	Dorsal flexion	15^0	20^0	Dorsal flexion	20^0
40^0	Inversion	35^0	40^0	Inversion	35^0
15^0	Eversion	10^0	20^0	Eversion	10^0

Table 12: Initial examination of ROM in Ankle joint

3.3.9. Muscle strength test (according to Kendall)

Lower extremities muscle strength test		
Right	**Muscle**	**Left**
4+	Tibialis anterior	4+
5	Extensor digitorum longus/brevis	5
5	Peroneus Tertius	5
5	Tibialis posterior	4
5	Flexor digitorum longus	4
5	Flexor digitorum brevis	5
4+	Peroneus longus	4-
4+	Peroneus brevis	4-
5	Gastrocnemius	4
5	Soleus	4
5	Hamstrings	5
5	Quadriceps	5
4	Gluteus medius	4
4	Gluteus minimus	4
5	Iliopsoas	5
5	Tensor fasciae latae	5
5	Sartorius	5
5	Rectus femoris	5
5	Piriformis	5
5	Gluteus maximus	4+
4+	Hip adductors	5
5	Flexor hallucis longus	4
5	Flexor hallucis brevis	5
5	Extensor hallucis longus/brevis	5
5	Plantaris	4

Table 13: Initial examination of muscle strength test in both lower extremities

3.3.10. Muscle length test (according to Janda)

Lower extremities muscle length test		
Right	**Muscle**	**Left**
0	Gastrocnemius - Plantaris	0
0	Soleus - Popliteus	0
0	Hip adductors	0
0	Piriformis	0
1	Iliopsoas	1
1	Rectus femoris	1
1	Hamstrings	1
0	Tensor fasciae latae	0

Table 14: Initial examination of muscle length test in both lower extremities

3.3.11. Muscle tone examination (Palpation)

Muscle tone for both lower extremities		
Right	**Muscle**	**Left**
Normotonic	Piriformis	Normotonic
Normotonic	Hamstrings	Normotonic
Hypertonic	Tensor fasciae latae	Hypertonic
Normotonic	Rectus femoris	Hypertonic
Normotonic	Vastus medialis/lateralis	Normotonic
Normotonic	Iliopsoas	Hypertonic
Hypertonic	Gluteus maximus	Hypertonic
Normotonic	Gluteus medius	Normotonic
Hypotonic	Hip adductors (brevis, longus, magnus, pectineus)	Hypotonic
Normotonic	Tibialis anterior	Normotonic
Hypertonic	Soleus	Hypertonic
Normotonic	Gastrocnemius	Normotonic

Table 15: Initial examination of muscle tone in both lower extremities

3.3.12. Joint play examination (according to Lewit)

Sacroiliac examination:

Stoddard's crossed-hands: No restriction for both sides

Upper part of sacroiliac joint: No restriction for both sides

Lower part of sacroiliac joint: No restriction for both sides

Patella examination:

No joint play is present in caudal direction for the left L.E.

Head of fibula:

Joint play is present in forward and backward direction for both L.E.

Lisfranc's joint:

No joint play is present in dorsal and plantar direction for the left L.E.

Chopart's joint:

No joint play is present in dorsal direction for the left L.E

Subtalar joint:

Joint play is present in distal and proximal direction for both L.E.

Talocrular joint:

Joint play is present in distal direction for both L.E.

Metatarsophalangeal joints:

Joint play is present in all metatarsophalangeal joints for both L.E.

3.3.13. Neurologic examination

3.3.13.1. Superficial sensation

Touch: physiological on both L.E.

3.3.13.2. Deep sensation

Stereognosis: physiological

Kinesthesia: physiological

Topognosis, Graphesthesia: physiological

3.3.13.3. Tendon reflexes

Patellar reflex: physiological (both sides)
Achilles tendon reflex: physiological (both sides)
Tibio-femoral-posterior reflex: physiological (both sides)
Peroneal-femoral-posterior reflex: physiological (both sides)
Adductor reflex: physiological (both sides)

3.3.14. Conclusion of initial kinesiology examination

From the initial kinesiology examination I have collect a lot of information and important findings that will help me in setting goals to the patient's rehabilitation plan.
During the posture evaluation in standing the weight bearing seemed to be more on the right side and the left shoulder was slightly elevated. Later on, when I performed the 2 scales test somehow I was contradicted about the weight bearing. The difference of 5 kg between the two sides was less than 10% of patient's weight (83kg) so the test was negative.
The dynamic test of maximal flexion was positive because the patient couldn't reach the floor with his fingers, although the ROM of the spine was equally distributed in all spinal segments. From this information in combination with the muscle length test I conclude that the hamstrings muscles are short in both sides.
During the examination of special test, the Rhomberg and Vele's test were both negative. Trendelenburg sign was also negative but while the patient was standing on his injured leg he was shaking as a result of his ankle instability.
From the anthropometric measurement examination, I have only noticed the difference of the ankle's circumference between the two sides. The left ankle's circumference is 1 cm bigger than the right ankle's circumference. This result lead us, to a minor swelling over the injured area.
The gait examination of the patient was quite physiological. On forward and backward walking he had the same stereotype of limited trunk rotation and his left step was slightly smaller and faster than the right one. While the patient was walking on heels he was leaning a bit forward and also when he tried to walk on toes he felt a bit uncomfortable so he didn't continue the specific walking.

In examination of basic movement patterns the abduction of hip joint worked with the tensor mechanism on both sides. We firstly had the activation of tensor fascia latae and after the gluteus medius and minimus. As I checked later from the muscle strength test the gluteal muscles were facing a mild weakness.

The ROM examination, measured by the goniometer, in the hip and knee joint gave as physiological results on both sides. In ankle joint there was less ROM mostly in plantar flexion and eversion of the left side. The limited ROM is physiological considering the brace that was placed in patient's ankle after the injury and the slight pain that the patient feels.

In muscles strength test I noticed that some muscles were weaker than other and mostly in the injured lower extremity. The weaker muscles were tibialis posterior, flexor digitorum longus, gastrocnemius, soleus, flexor halluces longus, plantaris, peroneus longus, peroneus brevis, gluteal muscles and tibialis anterior. The most of the weak muscles are providing the plantar flexion and eversion of the ankle.

In muscle length test, except of the hamstring that I mention its shortness before, I noticed a moderate shortness also on rectus femoris and iliopsoas muscles on both sides. Furthermore a lot of muscles were hypotonic and hypertonic. That was caused from the inactivity of some muscles and the hyperactivity of some others after the injury that the patient had.

During the joint play examination I found some restrictions between the bones to the affected area. There was restriction on dorsal and plantar direction to the Lisfranc's joint and on dorsal direction to the Chopart's joint. Moreover the left patella was restricted in caudal direction.

Finally the neurologic examinations of superficial sensation, deep sensation and tendon reflexes were all physiological on both lower extremities. So, after the ankle sprain, we didn't have any effect or injury on the nerves.

3.3.15. Therapy proposal

By collecting the information from all the different kind of examinations I will firstly focus on the general stabilization of the ankle. I believe that important for my patient is not only to strengthen the big muscles but also the small ones that are responsible for the ankle's stability. This will be achieved by proprioception exercises

and standing to uneven surfaces. Bosu ball, thick rope, balance and wobble boards are some of the instruments that will be used. For strengthening of muscles also we will provide exercises in all the ankle's directions with leg weights or thera-band for greater results. Modalities of electrotherapy (laser, shortwave, ultrasound) can be used for enhancing the healing procedure of the ligament and relieving the mild pain. As we conclude from the examinations there is a high tension in some muscles and for this reason lymphatic massage with a soft ball will be used aiming the release of hypertonic muscles and giving to the affected area a better blood circulation. The slight swelling that exist will be extinguish with cryotherapy that will be probably instructed as a home therapy in order of gaining time during rehabilitation. Moreover active and passive movements will be applied to regain the ROM of the ankle joint. The active and passive stretching, except of the short muscles will help to maintain the results of the ROM. During therapy I will use mobilization techniques for returning the joint play at the restricted joints of patella, Chopart and Lisfranc. At the beginning of each therapy for the purpose of aerobic fitness and warm up can be used by the patient the stationary cycle, stepping machine and treadmill. If it will be able, I will add hydrotherapy to my rehabilitation plan in order by swimming or running in the pool, the patient will gain stability and strengthening. Finally kinesio taping will add confidence and support during the rehabilitation but also will give stability and pain relief during activities.

3.4. Short term and long term rehabilitation plan

Short-term

- Total relief of pain
- Decrease the minor swelling on left ankle
- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles
- Stretching of the short muscles

Long-term

- Maintain and improve the short term rehabilitation plan results
- Correct the bad alignment of the upper body structures where is needed

- Improve muscle coordination by exercises focusing in different elements (static-dynamic balance, rhythm, spatial orientation, speed of reaction, synchronization of movement)
- Advices for preventing from further injuries in the ankle area

3.5. Rehabilitation plan progress

3.5.1. Session No: 1

Date/Time: 7/1/2016 - 3:00 p.m.

Present Status before therapy:

- Pain level: 1/10
- Minor swelling at the anterolateral area of the left ankle joint
- Patient is not in a good mood worrying about the recovery time

Goals of today's therapy session:

- Total relief of pain
- Decrease the minor swelling on left ankle
- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- In the beginning of the therapy session I felt right of speaking with my patient about his worries. For 5 minutes I explained him how the situation is and what are the goals that we have to follow in order of a soon recovery. Then we continue with the rehabilitation program.
- Soft tissue technique for 10 mins. Applied massage with a soft ball on both L.E for increasing the blood circulation, decreasing the swelling and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for tensor fascia latae, gluteus maximus, soleus on both sides and rectus femoris, iliopsoas on left side.
- Joint play mobilization (according Lewit) on the restricted joints of the left L.E. The restricted joints are the Chopart's joint in dorsal direction, Lisfranc's joint in dorsal and plantar direction and patella in caudal direction.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:

1. Standing with both legs on the posturomed device and by shaking forward-backward is trying to move the device to each direction every time. After that, is providing the same exercise at the sides by shaking on the right-left.
2. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. (3 repetitions in forward walking and 3 repetitions in side walking).

- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:
    1. Active movements for both L.E. in all directions of the ankle (inversion, eversion plantar and dorsal flexion) and with the resistance of thera band. (3sets x 10 repetitions)
    2. Walking on heel for 30 repetitions and after walking on toes for another 30 repetitions.
- Laser therapy, for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous
- Effects of today's therapy:

By the end of the first therapy the patient feels a little improvement in terms of balance and stability of his ankle. The pain and swelling still exist. No further improvements are observed.

- Self-therapy at home:
    - Active movements with resistance: The patient instructed to provide the movements of inversion, eversion, plantar and dorsal flexion with the resistance of thera band (3sets x 10 repetitions). It will be very helpful if he can provide this exercise 2 times per day.
    - Writing the Alphabet: The patient sits on a chair, elevates a bit his foot and by using the big toe as a pen he starts writing the letters of the alphabet in the air. (3 repetitions)

3.5.2. Session No: 2

Date/Time: 8/1/2016 - 3:00 p.m.

Present Status before therapy:

- Patient seems more confident than yesterday
- Pain level: 1/10
- Disappearance of swelling

Goals of today's therapy session:

- Total relief of pain
- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- Soft tissue technique for 10 mins. Applied massage with a soft ball on both L.E for increasing the blood circulation and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for tensor fascia latae, gluteus maximus, soleus on both sides and rectus femoris, iliopsoas on left side.
- Joint play mobilization (according Lewit) on the restricted joints of the left L.E. The restricted joints are the Chopart's joint in dorsal direction, Lisfranc's joint in dorsal and plantar direction and patella in caudal direction.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:
    1. Standing with both legs on the bosu ball trying to be on balance.
    2. Stepping from one wobble board to another, 7-8 in a row with different shapes and difficulty of each other. When the first leg is fully weight bearing the second one is in the air forming hip and knee flexion of 90°. On that time the patient also passes a ball, from one hand to another, under his elevated thigh. We were using the basket-ball.
    3. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. (3 repetitions in forward walking and 3 repetitions in side walking).
- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:

1. Active movements for both L.E. in all directions of the ankle (inversion, eversion plantar and dorsal flexion) and with the resistance of thera band. (3sets x 10 repetitions)
2. Walking on heel for 30 repetitions and after walking on toes for another 30 repetitions.

- Laser therapy for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous
- Effects of today's therapy:

At the end of the therapy the patient feels even better. He feels more coordination in the ankle and the ROM in plantar flexion of the left side is increased. The minor swelling disappeared but the pain still exist. No further improvements are observed.

- Self-therapy at home:
    - Active movements with resistance: The patient instructed to provide the movements of inversion, eversion, plantar and dorsal flexion with the resistance of thera band (3sets x 10 repetitions). 2-3 times per day for the weekend.
    - Writing the Alphabet: The patient sits on a chair, elevates a bit his foot and by using the big toe as a pen he starts writing the letters of the alphabet in the air. (3 repetitions)

3.5.3. Session No: 3

Date/Time: 11/1/2016 - 2:30 p.m.

Present Status before therapy:

- Pain level: 0/10
- The patient seem more optimistic about the final result of therapy

Goals of today's therapy session:

- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- Stationary bike for warm up.(10 mins)
- Soft tissue technique for 10 mins. Applied massage with a soft ball on both L.E for increasing the blood circulation and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for tensor fascia latae, soleus on both sides and rectus femoris, iliopsoas, gluteus maximus on left side.
- Joint play mobilization (according Lewit) on the restricted joints of the left L.E. The restricted joints are the Chopart's joint in dorsal direction, Lisfranc's joint in dorsal and plantar direction and patella in caudal direction.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:
    1. Standing with one leg on the bosu ball ant the other leg is 90° flexed on knee and hip joint. Changing standing leg every 20-30 seconds.
    2. Standing with both legs on the bosu ball and I am applying pressure to him, with my hands, in different directions.
    3. Stepping from one wobble board to another, 6 in a row with different shapes and difficulty of each other. When the first leg is fully weight bearing the second one is in the air forming hip and knee flexion of 90°. On that time the patient also passes a ball, from one hand to another, under his elevated thigh. We were using the basket-ball.
    4. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. (3 repetitions in forward walking and 3 repetitions in side walking).
- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:
    1. Active movements for both L.E. in all directions of the ankle (inversion, eversion, plantar and dorsal flexion) and with resistance of thera band. The resistance of thera band is bigger than previous days (3sets x 10 repetitions).
    2. Walking on heel for 30 repetitions and after walking on toes for another 30 repetitions.
- Laser therapy for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous

- Effects of today's therapy:

By the end of the therapy the patient feels satisfied. It seems that I gained his trust. He feels that his balance is getting better day by day. During the weekend he had total pain relief and while the exercises was feeling much more comfortable. Moreover the gluteus maximus on right side is returned back to the normal tone. No further improvements are observed.

- Self-therapy at home:
    - Active movements with resistance: The patient instructed to provide the movements of inversion, eversion, plantar and dorsal flexion with the resistance of thera band (3sets x 10 repetitions). 1 time per day
    - Writing the Alphabet: The patient sits on a chair, elevates a bit his foot and by using the big toe as a pen he starts writing the letters of the alphabet in the air. (3 repetitions)

3.5.4. Session No: 4

Date/Time: 12/1/2016 - 3:00 p.m.

Present Status before therapy:

- Pain level: 0/10
- The patient is in a good mood like previous days

Goals of today's therapy session:

- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- Stationary bike for warm up.(10 mins)
- Soft tissue technique for 10 mins. Applied massage with a different ball this time. We used the spiky ball on both L.E for increasing the blood circulation and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for tensor fascia latae, soleus on both sides and gluteus maximus on left side.

- Joint play mobilization (according Lewit) on the restricted joints of the left L.E. During examination of the patella I notice that joint is free so I continue with the other joints. The restricted joints are still the Chopart's joint in dorsal direction and Lisfranc's joint in dorsal and plantar direction.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:
    1. Standing with both legs on the bosu ball and I am throwing a ball towards him but not directly to his hands so it will be more difficult to catch it.
    2. Standing with one leg on the bosu ball ant the other leg is 90° flexed on knee and hip joint. Changing standing leg every 20-30 seconds.
    3. Stepping from one wobble board to another, 6 in a row with different shapes and difficulty of each other. When the first leg is fully weight bearing the second one is in the air forming hip and knee flexion of 90°. On that time the patient also passes a ball, from one hand to another, under his elevated thigh. We were using the basket-ball.
    4. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. (3 repetitions in forward walking and 3 repetitions in side walking).
- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:
    1. Active movements for both L.E. in all directions of the ankle (inversion, eversion, plantar and dorsal flexion) and with resistance of thera band. The resistance of thera band is bigger than previous days (3sets x 10 repetitions).
    2. Walking on heel for 30 repetitions and after walking on toes for another 30 repetitions.
- Laser therapy for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous
- Effects of today's therapy:

By the end of the forth therapy we had some great results in the tonicity of muscles. By a quick palpation the rectus femoris and iliopsoas muscles were not hypertonic anymore. The ROM is increased in plantar flexion and eversion on the left ankle. Moreover his balance

seems to get in better levels and the patella joint is not restricted anymore. No further improvements are observed.

- Self-therapy at home:
    - Picking up the towel: The patient puts a towel on the floor and with the plantar aspect of his food and mainly the toes is trying to pick it up. (15 repetitions)
    - Making circles: The patient sits on a chair, elevates a bit his foot and by using just the ankle makes circles through its entire ROM. (3sets x 10repetition)

3.5.5. Session No: 5

Date/Time: 13/1/2016 - 2:00 p.m.

Present Status before therapy:

- Pain level: 0/10
- Patient is in a good mood.

Goals of today's therapy session:

- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- Walking on the treadmill.(10 mins)
- Soft tissue technique for 10 mins. Applied massage with a spiky ball on both L.E for increasing the blood circulation and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for tensor fascia latae, soleus on both sides and gluteus maximus on left side.
- Joint play mobilization (according Lewit) on the restricted joint of the left L.E. The restriction is at the Chopart's joint in dorsal direction. Lisfranc's joint doesn't need any mobilization.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:

1. Standing with both legs on the bosu ball and I am throwing a ball towards him but not directly to his hands so it will be more difficult to catch it.
2. Standing with one leg on the bosu ball ant the other leg is 90° flexed on knee and hip joint. Changing standing leg every 20-30 seconds.
3. Stepping from one wobble board to another, 6 in a row with different shapes and difficulty of each other. When the first leg is fully weight bearing the second one is in the air forming hip and knee flexion of 90°. On that time the patient also passes a ball, from one hand to another, under his elevated thigh. We were using the basket-ball.
4. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. In every step that he does, he should move an overball from the one side of the rope to the other side. (3 repetitions in forward walking and 3 repetitions in side walking).

- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:
    1. Active movements for both L.E. in all directions of the ankle (inversion, eversion, plantar and dorsal flexion) and with resistance of thera band. The resistance of thera band is bigger than previous days (3sets x 10 repetitions)
    2. Providing squads on posturomed device (2sets x 15 repetitions)
- Laser therapy for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous
- Effects of today's therapy:

On this therapy session the ROM was increased in inversion on the left ankle. Due to the fact that every time we use different color (increased resistance) of thera-band and the patient does not face any difficulties providing the exercises, shows that muscles are increasing their strength. Linsfranc joint is now moving free without any restriction. The stability of ankle joint is getting better and better.

- Self-therapy at home:
    - Picking up the towel: The patient puts a towel on the floor and with the plantar aspect of his food and mainly the toes is trying to pick it up. (15 repetitions)

- Making circles: The patient sits on a chair, elevates a bit his foot and by using just the ankle makes circles through its entire ROM. (3sets x 10repetition)

3.5.6. Session No: 6

Date/Time: 14/1/2016 - 3:00 p.m.

Present Status before therapy:

- Pain level: 0/10
- The patient is in a very good mood

Goals of today's therapy session:

- Mobilization of the restricted joints
- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- Walking on the treadmill.(10 mins)
- Soft tissue technique for 10 mins. Applied massage with a spiky ball on both L.E for increasing the blood circulation and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for gluteus maximus on left side and tensor fascia latae on right side.
- Joint play mobilization (according Lewit) on the restricted joint of the left L.E. The restriction is at the Chopart's joint in dorsal direction.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:
    1. Standing with both legs on the bosu ball and I am throwing a ball towards him but not directly to his hands so it will be more difficult to catch it.
    2. Standing with one leg on the bosu ball ant the other leg is 90° flexed on knee and hip joint. Changing standing leg every 20-30 seconds.
    3. Stepping from one wobble board to another, 6 in a row with different shapes and difficulty of each other. When the first leg is fully weight

bearing the second one is in the air forming hip and knee flexion of 90°. On that time the patient also passes a ball, from one hand to another, under his elevated thigh. We were using the basket-ball.

4. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. In every step that he does, he should move an overball from the one side of the rope to the other side (3 repetitions in forward walking and 3 repetitions in side walking).

- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:
    1. Active movements for both L.E. in all directions of the ankle (inversion, eversion, plantar and dorsal flexion) and with resistance of thera band. The resistance of thera band is bigger than previous days (3sets x 10 repetitions)
    2. Providing squads on posturomed device (2sets x 15 repetitions)
- Laser therapy for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous
- Effects of today's therapy:

The patient at the end of the therapy feels released and he is very optimistic. Soleus muscles on both sides and tensor fascia latae on left side are not consider to be hypertonic anymore as they return to their normal tone. Considering the fact that every time the sensomotoric exercises are being more difficult, the postural stability of both foot is increasing and the muscles are getting stronger.

- Self-therapy at home:
    - Picking up the towel: The patient puts a towel on the floor and with the plantar aspect of his food and mainly the toes is trying to pick it up. (15 repetitions)
    - Making circles: The patient sits on a chair, elevates a bit his foot and by using just the ankle makes circles through its entire ROM. (3sets x 10repetition)

3.5.7. Session No: 7

Date/Time: 15/1/2016 – 2:00 p.m.

Present Status before therapy:

- Pain level: 0/10
- The patient, like previous days, is in a good mood

Goals of today's therapy session:

- Increase the ROM in ankle joint
- Strengthening of the weak muscles
- Improve the ankle joint stability and balance
- Relaxation of the hypertonic muscles

Sequence of therapeutic procedures:

- Walking on the treadmill.(10 mins)
- Soft tissue technique for 10 mins. Applied massage with a spiky ball on both L.E for increasing the blood circulation and for relaxation of hypertonic muscles.
- Post isometric relaxation technique on hypertonic muscles (3 repetitions for each one). I provided the technique for gluteus maximus on left side and tensor fascia latae on right side.
- Sensomotoric stimulation exercises for improving postural stability of the feet and proprioception - strength of the muscles:
    1. Standing with both legs on the bosu ball and I am throwing a ball towards him but not directly to his hands so it will be more difficult to catch it.
    2. Standing with one leg on the bosu ball ant the other leg is 90° flexed on knee and hip joint. Changing standing leg every 20-30 seconds.
    3. Stepping from one wobble board to another, 6 in a row with different shapes and difficulty of each other. When the first leg is fully weight bearing the second one is in the air forming hip and knee flexion of 90°.

On that time the patient also passes a ball, from one hand to another, under his elevated thigh. We were using the basket-ball.

4. Walking on the thick rope with a slow and step by step rhythm in order to cross the whole rope. In every step that he does, he should move an overball from the one side of the rope to the other side (3 repetitions in forward walking and 3 repetitions in side walking).

5. The patient, by wearing special balance sandals, provides stationary small steps and tries to keep his balance. Next stage is followed by spreading the legs at the side. Final stage is spreading the one leg forward and the other one backward. This exercise was not showed by me but by an instructor of the fitness center and I also provided it for myself.

- Exercises with thera band for strengthening the weak muscles and improving stability of the ankle joint:
    1. Active movements for both L.E. in all directions of the ankle (inversion, eversion, plantar and dorsal flexion) and with resistance of thera band. The resistance of thera band is bigger than previous days (3sets x 10 repetitions)
    2. Providing squads on posturomed device (2sets x 15 repetitions)
- Laser therapy for increasing the healing process of the tissues, pointed on the area of anterior talofibular ligament (10 mins)
    - Wavelength: 830 nm
    - Power: 1mW
    - Continuous
- Effects of today's therapy:

Today we didn't apply joint play mobilization as during the examination of Chopart's joint in dorsal direction I didn't feel any restriction. Moreover the ROM seems to be in physiological levels and for that reason the patient is happy and satisfied as well.

- Self-therapy at home:
    - On our last therapy I didn't advice any exercises for the home but I give some general tips to the patient like being more careful during his training and basketball games and also for a while to wear a protective brace for the ankle.

3.6. Final Kinesiology Examination
15/01/2016

3.6.1. Posture evaluation in standing

Feet distance	Feet close to each other
Transverse arch	Physiological
Longitudinal arch	Physiological
Knee	Physiological
Pelvis position	Same level
Umbilicus	Physiological
Thoracobrachial triangles	Symmetrical
Sternum	Middle line
Nipples	Symmetrical
Hands	Symmetrical
Clavicles	Symmetrical
Shoulders	Slight elevation on left side
Head position	Physiological
Weight bearing	Symmetrical

Table 16: Final postural examination- Anterior view

Ankle joint	Straight line
Knee joint	Straight line
Pelvis position	Slight anteflexion
Lumbar region of spine	Physiological lordosis
Thoracic region of spine	Physiological kyphosis
Shoulder position	Slight protraction of both shoulders
Cervical region of spine	Physiological lordosis
Head position	Slight protraction

Table 17: Final postural examination- Lateral View (both sides)

Heels position	Symmetrical
Achilles tendon	Prominent on both L.E
Calf	Symmetrical
Popliteal lines	Symmetrical
Subgluteal lines	Symmetrical
Iliac crests	On the same level (by palpation)
Posterior superior iliac spines	Symmetrical
Scapulas	On the same level. Right more prominent
Upper extremities	Symmetrical
Shoulders	Slight elevation on left side
Head position	Physiological

Table 18: Final postural examination- Posterior View

3.6.2. Dynamic test (Mobility of segments)

- Maximal extension: The movement is done without any restriction or pain.
- Lateroflexion: The movement is done, in both sides, without any restriction or pain.
- Maximal flexion: During maximal flexion the patient can not touch the floor and the distance between his fingers and the ground is 2 cm. Though he does not feel any pain.

3.6.3. Special test

- Vele's test: Negative on both sides
- Rhomberg test: Negative on both sides
- Trendelenburg test: Negative on both sides

3.6.4. Two scales test

Left	Right
42kg	41kg

Table 19: Final two scales test

3.6.5. Anthropometric measurement

3.6.5.1. Lower extremities Length – Circumferences

Left		Right
103cm	Anatomical length (ASIS)	103cm
114cm	Functional length (Umbilicus)	114cm
96cm	Length of thigh	96cm
49cm	Length of middle leg	49cm
25cm	Length of foot	25cm
43cm	Circumference of thigh (vastus medialis)	43cm
48cm	Circumference of thigh (quatriceps)	47,5cm
36cm	Circumference of knee	36cm
34,5cm	Circumference of calf	34cm
26cm	Circumference of ankle	26cm
24cm	Circumference of foot	24cm

Table 20: Final length and circumferences of lower extremities

3.6.6. Gait examination

3.6.6.1. Forward walking

Step phase: Physiological

Stance phase: Physiological

Rolling of feet: Physiological

Pelvis rotation: Physiological

Trunk movement: Limited trunk rotation

Movement of the arms: Physiological

3.6.6.2. Backward walking

Step phase: First contact point is with the toes and last point with the heel

Stance phase: Physiological

Rolling of feet: Physiological

Pelvis rotation: Physiological

Trunk movement: Limited trunk rotation

Movement of the arms: Physiological

3.6.6.3. Walking on toes

Physiological without any pain

3.6.6.4. Walking on heels

Physiological with good balance. The leaning forward stereotype was eliminate

3.6.7. Examination of basic movement patterns (according to Janda)

Extension of hip joint: Negative on both sides

Movement: The movement was done with the correct sequence of muscles activation. First gluteus maximus then hamstrings, contralateral spinal extensors muscles in lumbar region, ipsilateral spinal extensors muscles in lumbar region, contralateral spinal extensors muscles in thoracolumbar region, ipsilateral spinal extensors muscles in thoracolumbar region and final shoulder girdle muscles.

Abduction of hip joint: Negative on both sides

Movement: The movement was done with the correct sequence of muscles activation. First there was activation of gluteus medius and minimus and after the tensor fascia latae.

Curl up (trunk flexion): Negative on both sides

Movement: The patient didn't have any problem to provide the sitting up position from supine and the whole motion was smooth.

3.6.8. Range of motion examination (according to Kendall)

Hip Joint					
Right	**Active**	**Left**	**Right**	**Passive**	**Left**
10^0	Extension	10^0	10^0	Extension	10^0
115^0	Flexion	115^0	120^0	Flexion	120^0
35^0	Abduction	35^0	40^0	Abduction	40^0
10^0	Adduction	10^0	10^0	Adduction	10^0
40^0	Internal rotation	40^0	40^0	Internal rotation	40^0
35^0	External rotation	35^0	40^0	External rotation	40^0

Table 21: Final examination of the ROM in Hip joint

Knee Joint					
Right	**Active**	**Left**	**Right**	**Passive**	**Left**
-	**Knee joint**	-	-	**Knee joint**	-
0^0	Extension	0^0	0^0	Extension	0^0
125^0	Flexion	125^0	130^0	Flexion	130^0

Table 22: Final examination of the ROM in Knee joint

Ankle Joint					
Right	**Active**	**Left**	**Right**	**Passive**	**Left**
40^0	Plantar flexion	40^0	45^0	Plantar flexion	45^0
20^0	Dorsal flexion	20^0	20^0	Dorsal flexion	20^0
40^0	Inversion	35^0	40^0	Inversion	40^0
20^0	Eversion	17^0	20^0	Eversion	20^0

Table 23: Final examination of ROM in Ankle joint

3.6.9. Muscle strength test (according to Kendall)

Lower extremities muscle strength test		
Right	**Muscle**	**Left**
5	Tibialis anterior	5
5	Extensor digitorum longus/brevis	5
5	Peroneus Tertius	5
5	Tibialis posterior	5
5	Flexor digitorum longus	5
5	Flexor digitorum brevis	5
5	Peroneus longus	5
5	Peroneus brevis	5
5	Gastrocnemius	5
5	Soleus	5
5	Hamstrings	5
5	Quadriceps	5
5	Gluteus medius	5
5	Gluteus minimus	5
5	Iliopsoas	5
5	Tensor fasciae latae	5
5	Sartorius	5
5	Rectus femoris	5
5	Piriformis	5
5	Gluteus maximus	5
5	Hip adductors	5
5	Flexor hallucis longus	5
5	Flexor hallucis brevis	5
5	Extensor hallucis longus/brevis	5
5	Plantaris	5

Table 24: Final examination of both lower extremities muscle strength test

3.6.10. Muscle length test (according to Janda)

Lower extremities muscle length test		
Right	**Muscle**	**Left**
0	Gastrocnemius - Plantaris	0
0	Soleus - Popliteus	0
0	Hip adductors	0
0	Piriformis	0
0	Iliopsoas	0
0	Rectus femoris	0
1	Hamstrings	1
0	Tensor fasciae latae	0

Table 25: Final examination for both lower extremities muscles length test

3.6.11. Muscle tone examination (Palpation)

Muscle tone for both lower extremities		
Right	**Muscle**	**Left**
Normotonic	Piriformis	Normotonic
Hypertonic	Hamstrings	Normotonic
Normotonic	Tensor fasciae latae	Normotonic
Normotonic	Rectus femoris	Normotonic
Normotonic	Vastus medialis/lateralis	Normotonic
Normotonic	Iliopsoas	Normotonic
Normotonic	Gluteus maximus	Normotonic
Normotonic	Gluteus medius	Normotonic
Hypotonic	Hip adductors (brevis, longus, magnus, pectineus)	Normotonic
Normotonic	Tibialis anterior	Normotonic
Normotonic	Soleus	Normotonic
Normotonic	Gastrocnemius	Normotonic

Table 26: Final examination for muscle tone for both lower extremities

3.6.12. Joint play examination (according to Lewit)

Sacroiliac examination:

Stoddard's crossed-hands: No restriction for both sides

Upper part of sacroiliac joint: No restriction for both sides

Lower part of sacroiliac joint: No restriction for both sides

Patella examination:

Joint play is present in all direction for both L.E.

Head of fibula:

Joint play is present in forward and backward direction for both L.E.

Lisfranc's joint:

Joint play is present in dorsal and plantar direction for both L.E.

Chopart's joint:

Joint play is present in dorsal direction for the left L.E

Subtalar joint:

Joint play is present in distal and proximal direction for both L.E.

Talocrular joint:

Joint play is present in distal direction for both L.E.

Metatarsophalangeal joints:

Joint play is present in all metatarsophalangeal joints for both L.E.

3.6.13. Neurologic examination

3.6.13.1. Superficial sensation

Touch: physiological on both L.E.

3.6.13.2. Deep sensation

Stereognosis: physiological

Kinesthesia: physiological

Topognosis, Graphesthesia: physiological

3.6.13.3. Tendon reflexes

Patellar reflex: physiological (both sides)
Achilles tendon reflex: physiological (both sides)
Tibio-femoral-posterior reflex: physiological (both sides)
Peroneal-femoral-posterior reflex: physiological (both sides)
Adductor reflex: physiological (both sides)

3.7. Evaluation of the effect of the therapy

On the 6th of January I had the first meeting with T.B. The patient was diagnosed with ankle sprain after an injury from a basketball game. At that day he was going to have his 1st rehabilitation session. After a consultation with my supervisor T.B became the patient for my bachelor thesis. On the same day we procced to the initial kinesiology examination.

During the initial kinesiology examination the results that came out were more or less expected. I didn't observed any severe limitation regarding movement and even the pain was in a minimal level. Some noticeable results were the restrictions in joint play, few shortened muscles and some other hypertonic ones. In addition the most important and interesting outcome, that we had from the examinations, was the unbalanced posture most probably resulted from the weakness of some muscles.

Although I didn't have big deviations from what I was expecting, I collected a lot of important information that helped me set the short and long term rehabilitation plan. By setting the right goals for my therapy, then was easier for me to achieve these goals in a maximal level. As I believe, and with the help of my supervisor, we had a good final result.

The effect of the physiotherapy sessions, if you take in mind the final kinesiology examinations seems to be very positive. An important fact is that from the early 2-3 sessions we totally eliminate the swelling from the ankle and the feeling of pain. In every session we were increasing the ROM of the injured joint, sometimes with a less and sometimes with a more noticeable improvement. By the end of the 7th session we fully regained the ROM in all the restricted movements of the ankle joint. The joint play was

restored, by mobilization techniques, from the restricted patella, Chopard's and Lisfranc's joints. By the help of PIR technique we regained the normal tone of the hypertonic muscles and we relaxed the short muscles. Finally the sensomotoric stimulation exercises strengthened the weak muscles, leading the patient to a better stability and giving him a good balanced posture. The most important and noticeable results of my therapy are pointed below to an analysis of before and after:

Examination procedure	**Object being examined**	**Results**	
		Before	**After**
Gait	Walking on toes	Unable	Able (physiological)
Gait	Walking on heels	Unbalance gait + Leaning forward	Physiological
Strength test	Peroneus longus	4-	5
Strength test	Peroneus brevis	4-	5
Strength test	Tibialis posterior	4	5
Strength test	Flexor digitorum long.	4	5
Strength test	Gastrocnemius	4	5
Strength test	Soleus	4	5
Strength test	Gluteus medius	4	5
Strength test	Gluteus minimus	4	5
Strength test	Flexor hallucis long.	4	5
Strength test	Plantaris	4	5
R.O.M	Active plantar flexion	30^0	40^0
R.O.M	Active dorsal flexion	15^0	20^0
R.O.M	Inversion	35^0	35^0
R.O.M	Eversion	10^0	17^0
Special test	Trendelengurg	Unbalnce posture	Physiological
Palpation	Tensor fascia latae (both)	Hypertonic	Normotonic
Palpation	Rectus femoris (left)	Hypertonic	Normotonic
Palpation	Iliopsoas (left)	Hypertonic	Normotonic
Palpation	Gluteus maximus (both)	Hypertonic	Normotonic
Palpation	Soleus (both)	Hypertonic	Normotonic

Table 27: Therapy results – before and after

3.8. Prognosis

I don’t have so much work experience to clearly speak about the prognosis of my patient. In addition I will point my opinion from what I saw through our rehabilitation sessions. The results of the final kinesiology examination were much positive and with a bit more work the patient will be fit and healthy. The work though doesn’t stop there because he has to maintain in this form. Moreover, based on his strong will and how good learner he was, through our sessions, I can say that very soon he will be back in the basket fields.

4. Conclusion

During my practice, that held for 2 weeks, I have learned and gained so many new things. One important thing that I really understood is that if the physiotherapist apply a good rehabilitation plan from the beginning the right results will come much easier than probably expected. Moreover during my time at the clinic I phased a lot of different situations and I don’t speak only about the diagnosis but also about the different types of human characters and how this can differentiate the rehabilitation process.

The very good communication and cooperation that I and my patient had lead us to a sooner recovery time. I believe that also optimism and positive thinking can have greater results and quicker rehabilitation process.

At the end I would like to thank my supervisor Mgr. Zaher El Ali for his professional guidance.

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6. SUPPLEMENTS

6.1. List of Tables

6.2. List of Figures

6.3. Abbreviations

CLPA= Centrum Lecby Pohyboveho Aparatu

RICE= Rest Ice Compression Elevation

PRICES= Protection Rest Ice Compression Elevation Support

ROM= Range Of Motion

MRI= Magnetic Resonance Imaging

LE= Lower Extremity

Nm= nanometers

mW= microvolts

6.4. Photo Documentation

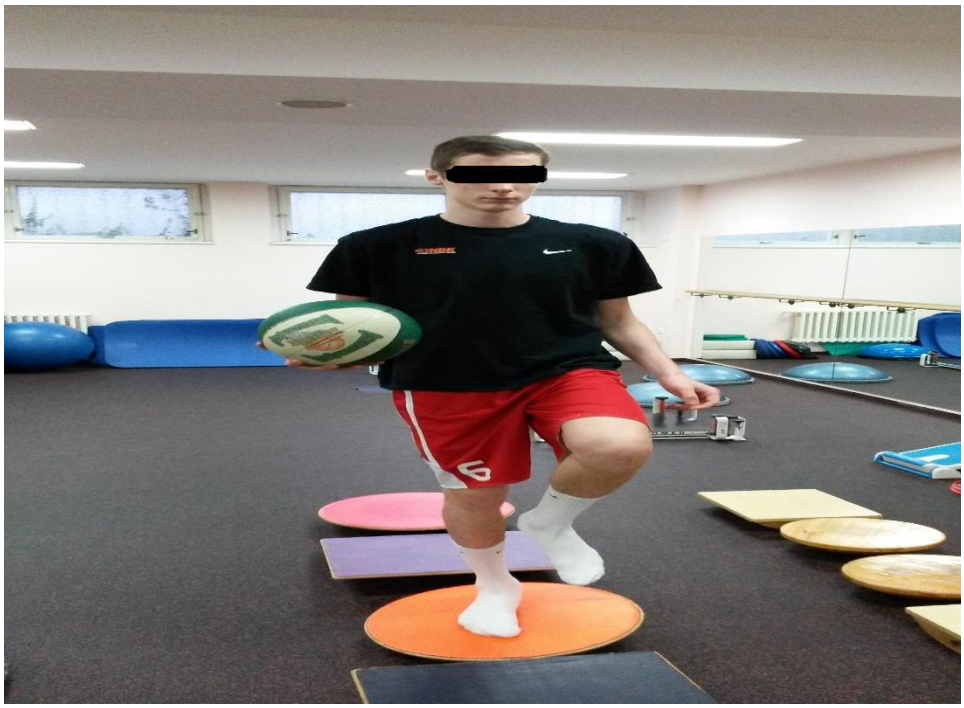


Photo1: Walking on wobble boards

Photo2: Walking on wobble boards and passing the ball under the leg

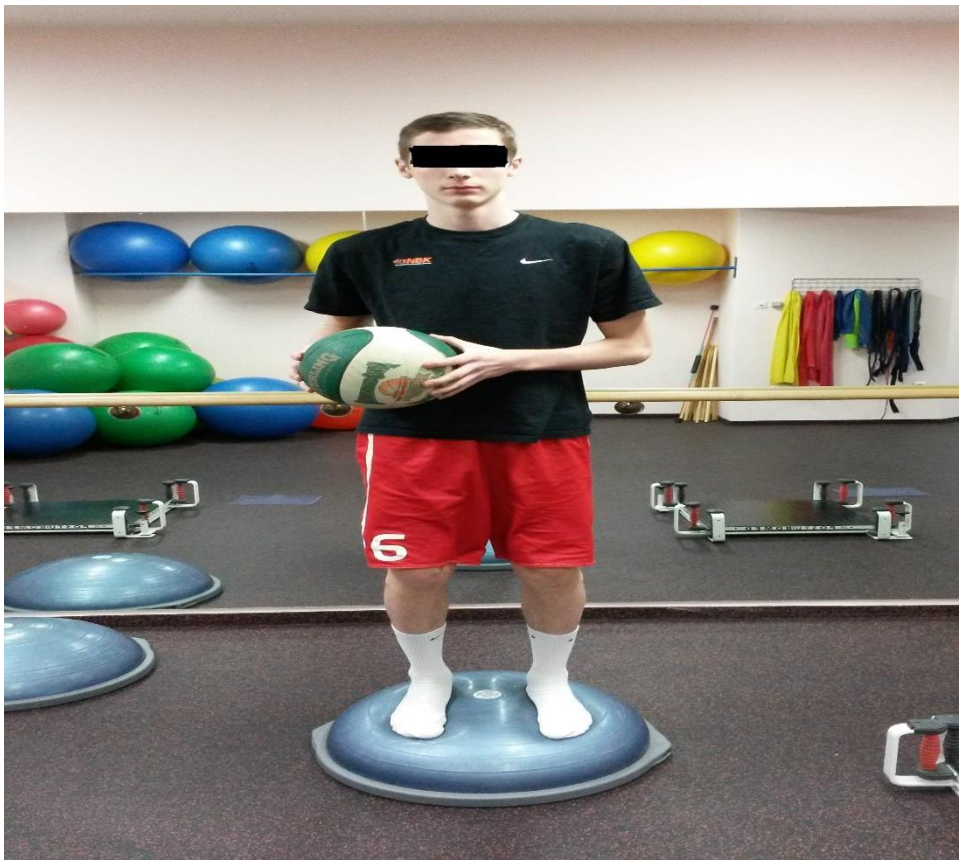
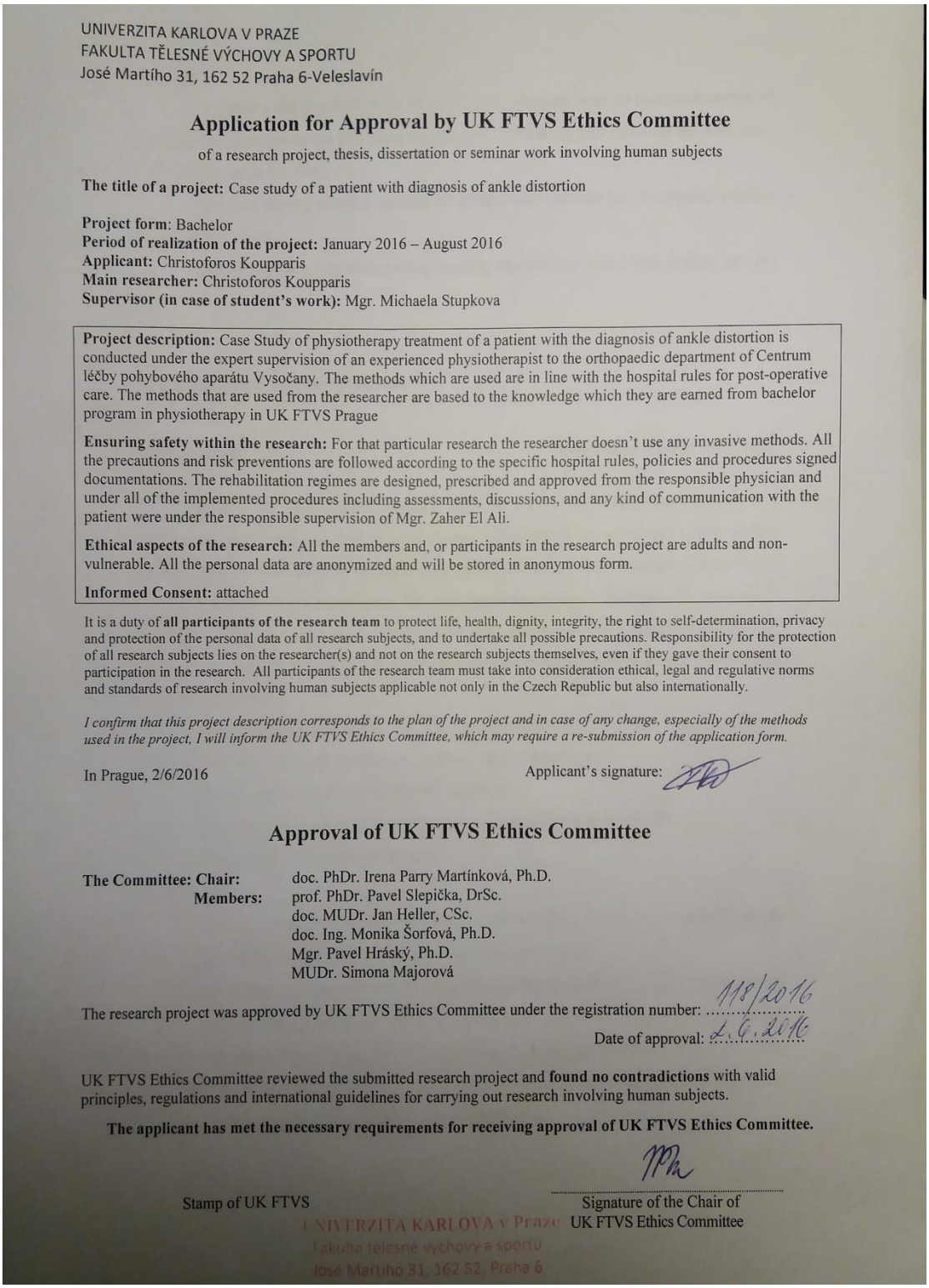


Photo3: Throw and catch of basketball on the bosu

Photo 4: Walking on the thick rope

6.5. Application for Ethics Board Review



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

Application for Approval by UK FTVS Ethics Committee

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

The title of a project: Case study of a patient with diagnosis of ankle distortion

Project form: Bachelor
Period of realization of the project: January 2016 – August 2016
Applicant: Christoforos Koupparis
Main researcher: Christoforos Koupparis
Supervisor (in case of student's work): Mgr. Michaela Stupkova

Project description: Case Study of physiotherapy treatment of a patient with the diagnosis of ankle distortion is conducted under the expert supervision of an experienced physiotherapist to the orthopaedic department of Centrum léčby pohybového aparátu Vysočany. The methods which are used are in line with the hospital rules for post-operative care. The methods that are used from the researcher are based to the knowledge which they are earned from bachelor program in physiotherapy in UK FTVS Prague

Ensuring safety within the research: For that particular research the researcher doesn't use any invasive methods. All the precautions and risk preventions are followed according to the specific hospital rules, policies and procedures signed documentations. The rehabilitation regimes are designed, prescribed and approved from the responsible physician and under all of the implemented procedures including assessments, discussions, and any kind of communication with the patient were under the responsible supervision of Mgr. Zaher El Ali.

Ethical aspects of the research: All the members and, or participants in the research project are adults and non-vulnerable. All the personal data are anonymized and will be stored in anonymous form.

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, 2/6/2016 Applicant's signature:

Approval of UK FTVS Ethics Committee

The Committee: Chair: doc. PhDr. Irena Parry Martínková, Ph.D.
Members: prof. PhDr. Pavel Slepička, DrSc.
doc. MUDr. Jan Heller, CSc.
doc. Ing. Monika Šorfová, Ph.D.
Mgr. Pavel Hrásky, Ph.D.
MUDr. Simona Majorová

The research project was approved by UK FTVS Ethics Committee under the registration number: 118/2016

Date of approval: 2. 6. 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.

Stamp of UK FTVS

UNIVERZITA KARLOVA v Praze
Fakulta tělesné výchovy a sportu
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Signature of the Chair of UK FTVS Ethics Committee