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PILATES TRAINING PROGRAM FOR FEMALE RINGETTE PLAYERS: PREVENTING KNEE LIGAMENT TEARS AND RUPTURES

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The purpose of this thesis was to plan a Pilates training program for girls to prevent knee ligament injuries among young ringette players. The aim was to plan an effective program that is different to the sport-specific training of ringette. This material was collected through literature review and the thesis method is practice based. Practice based thesis has a literature part and a product.

Injuries in ringette are common even though contact is prohibited. Most of the injuries occur to upper or lower extremities. Most common injuries within 16 to 17 years old players' are knee injuries.

Knee is a stable joint which is supported by the joint structure, ligaments, tendons and muscles. The knee joint is quite simple and the range of motion is quite limited. To reach the needed stability the supporting muscles need to be strong and active. In relations to knee strong gluteal, thigh and calf muscles are required.

Knee injuries can happen in a various ways. It can be for example a sudden weight shift from leg to another, twist to the knee or a sudden stop. There are some ligaments that are more prone to injure than others. These ligaments are the anterior and posterior cruciate ligaments and lateral collateral and medial collateral ligaments.

Knee injuries can be prevented to some extent. Proper warm up before exercising, strong and flexible muscles are prevention factors. Also it is important to improve and maintain good balance and agility of the lower extremities. Pilates is a type of therapeutic exercise that can be used in the prevention and rehabilitation of musculoskeletal disorders. Pilates for example develops and increases strength, flexibility, endurance, body control and awareness.

CONTENTS

1 INTRODUCTION

Injuries vary with age in the sport of ringette. 10-year-old players tend to injure differently than 16-17-year-old players. The older the players are the more they will be injured to the upper or lower extremities. Among 16-17 years old the nature of the injury is most often a tear or a rupture of a knee ligament. Also in the women's ice hockey most injuries occur to the knee. 37,1% are the injuries of ligamentum medial collateral and anterior cruciate ligamentum ruptures occur in 11,4% from all the knee injuries. (Keays, Gagnon & Friedman 2014; Tuominen, Stuart, Aubry, Kannus, Tokola, & Parkkari. 2015.)

Knee joint is quite a simple joint by its structure and function and the range of motion is quite limited. Knee is a stable joint which is supported by the joint structure, ligaments, tendons and muscles. Strong muscles are required to achieve the needed stability. Gluteal-, thigh- and calf muscles are muscles supporting and connected to the knee. (Schuenke, Schulte & Schumacher 2006)

Knee ligament injuries can be prevented with a precise warm-up, strong muscles, improving flexibility, balance and agility. Pilates training is opposite to the sports specific training of ringette. It is also used in rehabilitating of musculoskeletal problems. The idea in Pilates is that the movements are done correctly and precisely and that the trainee is concentrating on the performance. (Chiaia, De Mille, 2009; Smith, Kelly & Monks 2004; Suomen Pilatesyhdistys www-page 2016.)

2 PURPOSE OF THE THESIS

The purpose of this thesis was to plan a Pilates training program for girls to prevent knee ligament injuries among young ringette players. The aim was to plan a program that is effective and different to their already existing training related to ringette. The material was collected through a literature review.

3 RINGETTE

Ringette is a fast team sport for women which requires accuracy, speed and intelligence. Skating skill is the most important skill in ringette. The sport is played on the ice and it was invented in Canada. Sam Jacks invented ringette in the 1960' in North Bay, Ontario. Ringette has been played in Finland now for over 30 years. (Kaukalopallo- ja ringetteliitto ry www-page 2016; Turun Ringette www-page 2016)

Ringette is played on the ice hockey rink and a player needs to have ice hockey skates, a helmet, padding for knees and elbows, gloves, protection for neck and a stick for playing. The goalkeeper has a special goalie stick. As playing equipment there is a blue rubber ring that the goals are made with. The gear and the playing equipment are seen in the Figure 1 below. (Suomen Ringetteliitto ry www-page 2016)

Figure 1 - Female players playing ringette (Suomen Ringetteliitto ry www-page 2016)

In ringette there are five players and a goalkeeper on the ice for both teams. Two defenders, two offenders and one center. The main aim is to get a blue rubber ring into the goal. On the ice there are different lines for different purposes. There are two larger blue lines where a player needs to pass the ring for a teammate. There are also red thin lines before the goal and those lines are separating an offence area where

only three players from each team can be in (plus the defending goalie). The lines and the rink are seen in the Figure 2. In the offence area there is a 30 second time-rule. The offending team has 30 seconds time to make a pass towards the goal or the defending team has to touch the ring and then the time will start over. There is a specific area for the goalkeeper and for safety reasons it is forbidden for a player to go into that area or take the ring from there. For any fault of the rules follows a penalty. The penalties are usually 2 or 4 minute penalties in the penalty box. The most usual fault of the rules are; interference, intentional body contact, slashing and playing in the wrong area. (Suomen Ringetteliitto ry www-page 2016.)

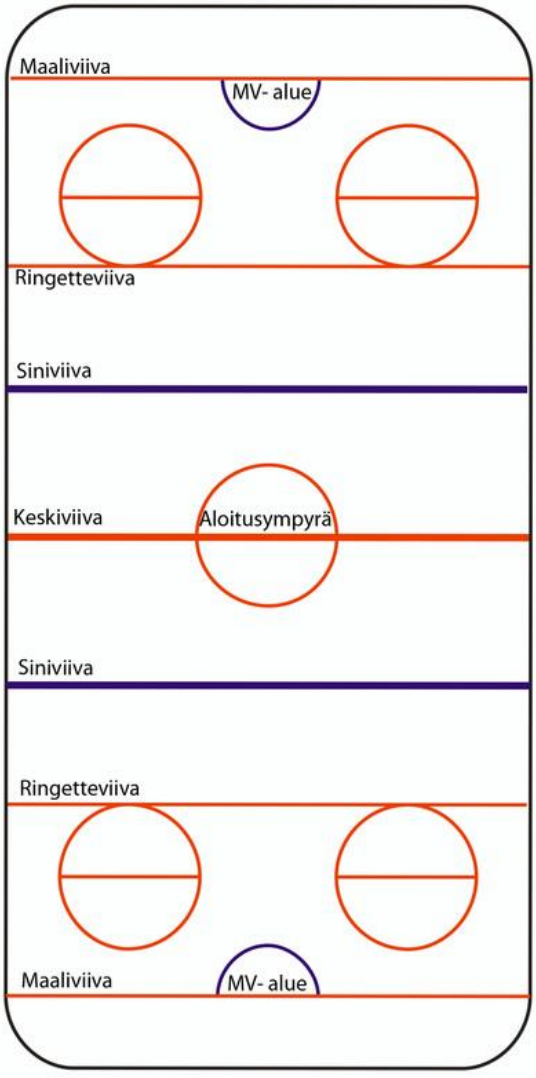

Figure 2 - Picture of an ice rink (Ringette Kangasniemi www-page 2016)

In ringette contact is prohibited but still a lot of injuries happen also because of the contact. If leaving out the head injuries mostly the players are injured in the upper or lower extremities. The natures of these injuries are often fractures and contusions to both upper and lower extremities. Like mentioned in the introduction part of this thesis the injuries vary with age. Among 16-17 years old players the injuries most often are tears or ruptures of a knee ligament. (Keays, Gagnon & Friedman 2014, 24:326-330)

4 KNEE

4.1 Anatomy

Knee is a very complex and diverse by its anatomy. It consists of many different structures and mechanisms and all of those have their own part to play. In the knee there are bones, ligaments, tendons, muscles and joint structures. Without a knee we could not walk, run, do many sports or perform many simple daily activities. The knee joint is quite simple and the range of motion is quite limited. It is important to keep alignments straight in our legs so that the knees would be healthy and strong. Knee is a structure that is stable and it is supported by the joint structure, ligaments, tendons and muscles. It is important to have strong muscles in the gluteal, thigh and calf area so that the knee has the stability that is needed.

4.1.1 Synovial joint

The knee joint is a synovial joint (junctura synovialis). Synovial joint is a hinge of two bones that allows movement, see Figure 3. In the synovial joint there are a joint capsule (capsula articularis), joint surfaces (facies articularis) and an articular cavity (cavitas articularis). There are certain things that effect on the range of motion of the joint. These effecting factors are the structure type of the joint, age, joint capsule, ligaments, muscles and their tendons. These effecting factors can be estimated and measured in percents. Factors limiting the ROM are the joint capsule 47%, muscles and faskia 41%, tendons and ligaments 10% and skin 2%. (Schuenke et al. 2006)

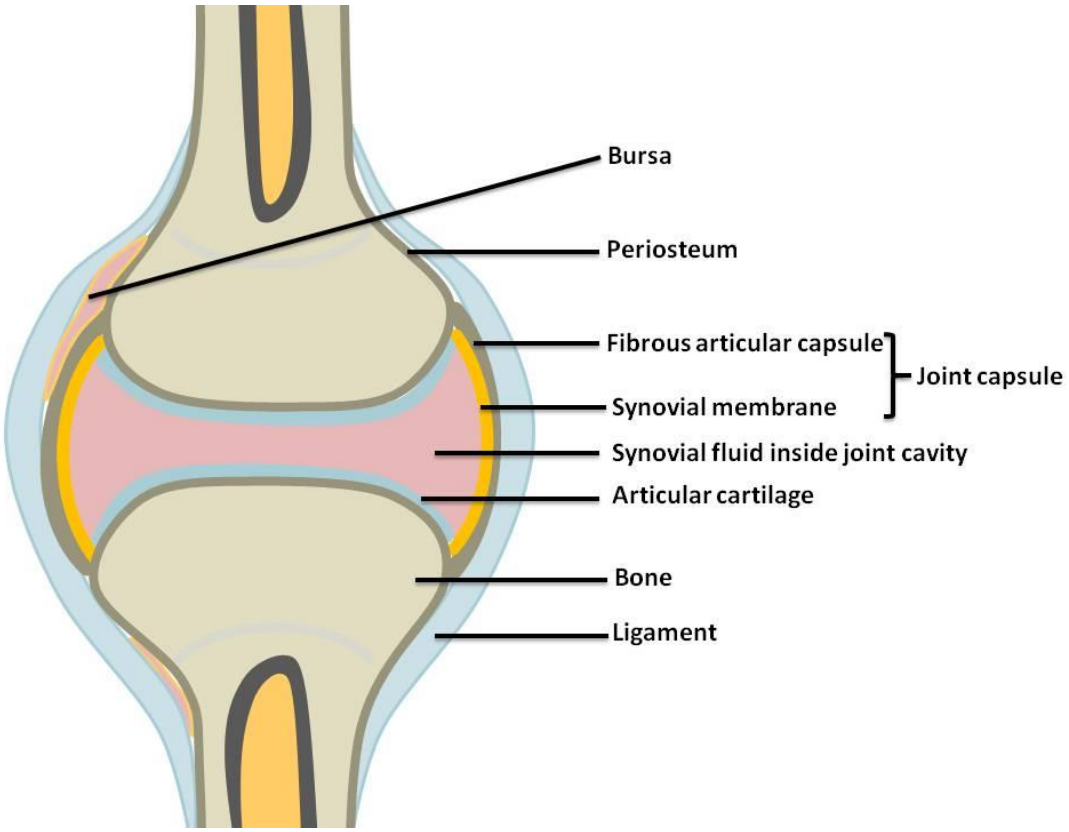

Figure 3 - Picture of a synovial joint (Algonquin College www-page 2016)

Articular cavity (cavitas articularis) is a solid space filled with articular fluids. Articular cavity is found inside the articular capsule. Synovial fluid (synovia) is a fluid that is comparable with an egg white. It lubricates the joint and nourishes the articular cartilage. After an injury the amount of synovial fluids increases and causes pressure to the joint which then causes pain and the ROM of the joint decreases. If there is not enough of the synovial fluids in the joint it causes too much friction and pain increases and the surface of the joint wears out. Meniscus functions as a shock absorber. They also enable the articular surfaces to be more consistence together. Articular disk (discus articularis) is a cartilage disk that extends through the whole joint. Labrum articulare is a cartilage ring that circles around the surfaces of a joint. It is also making the joint deeper. Synovial membrane (membrane synoviale) is producing joint fluids that lubricate the joint. Synovial membrane can be found inside the joint capsule. Ligament (ligamentum) attaches the bones of the joint together. It is built from a connective tissue that barely stretches. It supports the joint and the ligaments can be extensions of muscles or tendons. Facies articularis is covered with a thin layer of joint cartilage. It can be found in the surface of a bone inside a joint.

This certain cartilage is also called hyaline. Hyaline is smooth glass-like material and it is nonrenewable. Articularis capsule (capsula articularis) is a solid connective tissue sac that reaches from bone to bone. It is made from a connective tissue that barely stretches. The articularis capsule can be very tight and in that case it holds the articularis surfaces well together. The capsule can also be rather loose. If the capsule is loose then it is the other structures that stabilize the joint. Membrana fibrosa is a membrane surrounding the articularis capsule from outside. (Schuenke et al. 2006)

4.1.2 Knee joint

Knee joint (Art. genus) is a hinge joint in which movement is happening at only one level. The movement is seen in flexion and extension of the knee. In a normal ROM the knee joint flexion is 0-140 degrees, hyperextension 0-5 degrees, internal rotation with a flexion in the knee 10 degrees and external rotation with flexion 40 degrees. Medial and lateral condyles of the femur and facies articular superior of the tibia are the joint surfaces of the knee joint. Also facies patellar femorii of the patellar bone is included. These joint surfaces are seen in the Figure 4.

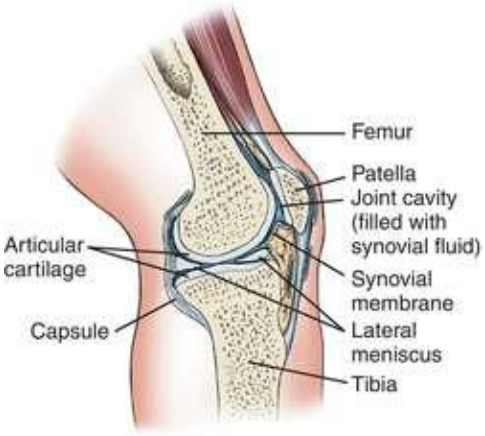

Figure 4 - Picture of a knee joint (The Free Dictionary www-page 2016)

There are specific structures found in the knee joint; Articularis capsule is a capsule that consists of membrane fibrosa and membrane synovialis. Plica synovialis infrapatellaris is a joint membrane. Corpus adiposum infrapatellare is the fat tissue in between these membranes. Meniscus is a structure that is between the bony structures and is reducing friction. It is attached to eminentia intercondylaris. It is a carti-

lage tissue, shaped like a letter C and functioning like a cushion. Then there are also several ligaments in the joint. (Schuenke et al. 2006)

4.1.3 Ligaments of the knee

Ligaments can be divided into two categories; extrinsic and intrinsic ligaments. Extrinsic ligaments in the anterior side are ligamentum patellar which is supporting the knee joint from the anterior side. Patella functions as a sesame bone and guides the functioning of the ligament. Lig. patellar is an extension of m. quadriceps femoris tendon and it attaches to tuberositas tibiae. Lig. Retinaculum patellae longitudinale mediale, lig. retinaculum patellae longitudinale laterale, lig. retinaculum patellae transversal mediale and lig. retinaculum patellae transversal laterale all stabilize the patella anteriorly. In the medial lateral side is a lig. collateral medial/tibiale. It strengthens the joint capsule medially as a thick band. It is attached from epicondyle mediale femorii to epicondyle mediale tibiale. It is partly attached to the joint capsule as well. Ligamentum collateral lateralie/fibulare is the ligament in the lateral side. These ligaments are seen in the Figure 5 below.

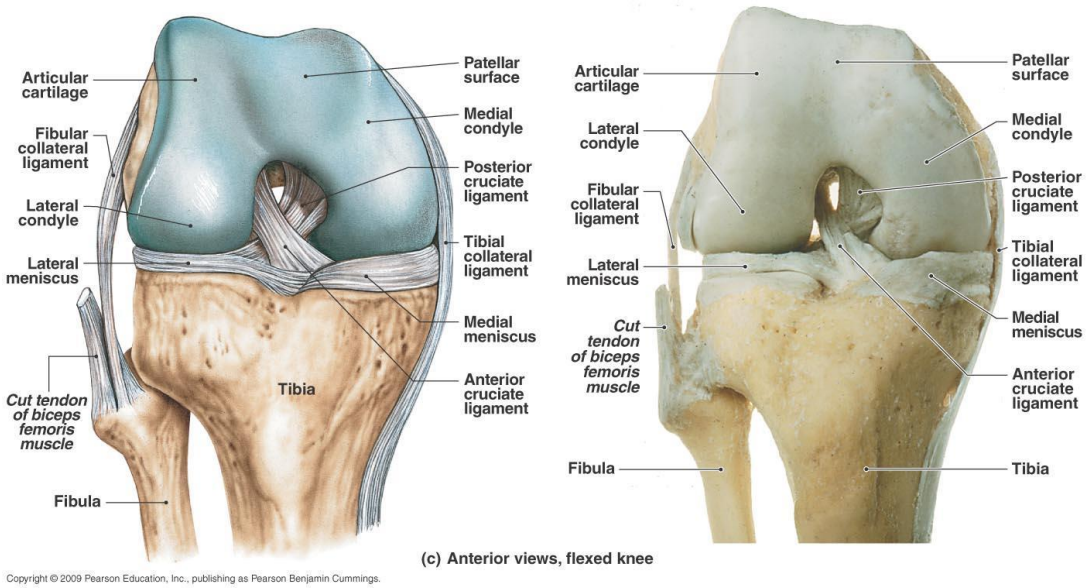

Figure 5 - Picture of the knee ligaments (Yeditepe University Faculty of medicine 1st Year Anatomy Blog www-page 2016)

It strengthens the joint capsule laterally and it is thinner than lig. collaterale medial. It attaches from epicondyle laterale femorii to caput fibulae. The lig. collateral lat-

eral. activate in the extension of the knee and loosens in flexion of the knee allowing rotation movements. In the posterior side are ligamentum popliteum obliquum and ligamentum popliteum arcuatum. Both of these ligaments strengthen the joint capsule. (Schuenke et al. 2006)

Intrinsic ligaments are the following ligaments. Lig. cruciatum anterior is preventing the tibia bone from gliding too far anteriorly and rotating externally. It attaches from condyles mediale femorii inner surface to eminentia intercondyle from the front down. Lig. cruciatum posterior prevents the joint from moving too far posteriorly and rotating internally. It attaches from the condyle mediale femorii inner surface to eminentia intercondylaris from front down. The medial and lateral meniscii are atteched with a ligamentum transversum genus. The thickness of the ligament varies and sometimes it doesn't even exist. There are also ligaments called lig. meniscofemoral anterior (Ligament of Humphrey) and lig. meniscofemoral posterior (Ligament of Wrisberg). 70% of knees have either one of these ligaments and 6% of knees have both of these ligaments. The Humphrey's ligament attaches from the lateral meniscus to femoral posterior cruciate ligament and the Wrisberg's ligament attaches from the lateral meniscus to the medial femoral condyle. (Gaivoronskiy, Kurtseva, Gaivoronskaya & Nichiporuk, 2016; IMAIOS www-page, 2016; Schuenke et al. 2006; Wheelers, Nunley & Urbaniak, 2014)

4.1.4 Muscles of the knee

Tendons connect the muscles to the bones. The muscles either support and stabilize the knee or produce movement in the knee joint. The muscles are divided into muscle groups. Muscle groups that are related to the knee joint are quadriceps, hamstrings and muscles of the calf. Then there are also individual muscles involved as well. The hamstrings consist of the following muscles; biceps femoris, semitendinosus and semimembranosus. These muscles are the flexor muscles of the knee joint. M. gracilis, sartorius, popliteus and gastrocnemius are also involved in the knee flexion. (Schuenke et al. 2006)

Vastus lateralis, vastus medialis and vastus intermedialis form the quadriceps muscle group. Quadricep muscles do the extension of the knee joint. Also involved in the extension movement is tensor faskia latae. (Schuenke et al. 2006)

External rotation of the knee joint is done by biceps femoris and tensor faskia latae muscles. And internal rotation of the knee is done by semitendinosus, semimembranosus, gracilis, sartorius and popliteus muscles. Most of these muscles can be seen in Figure 6. (Schuenke et al. 2006)

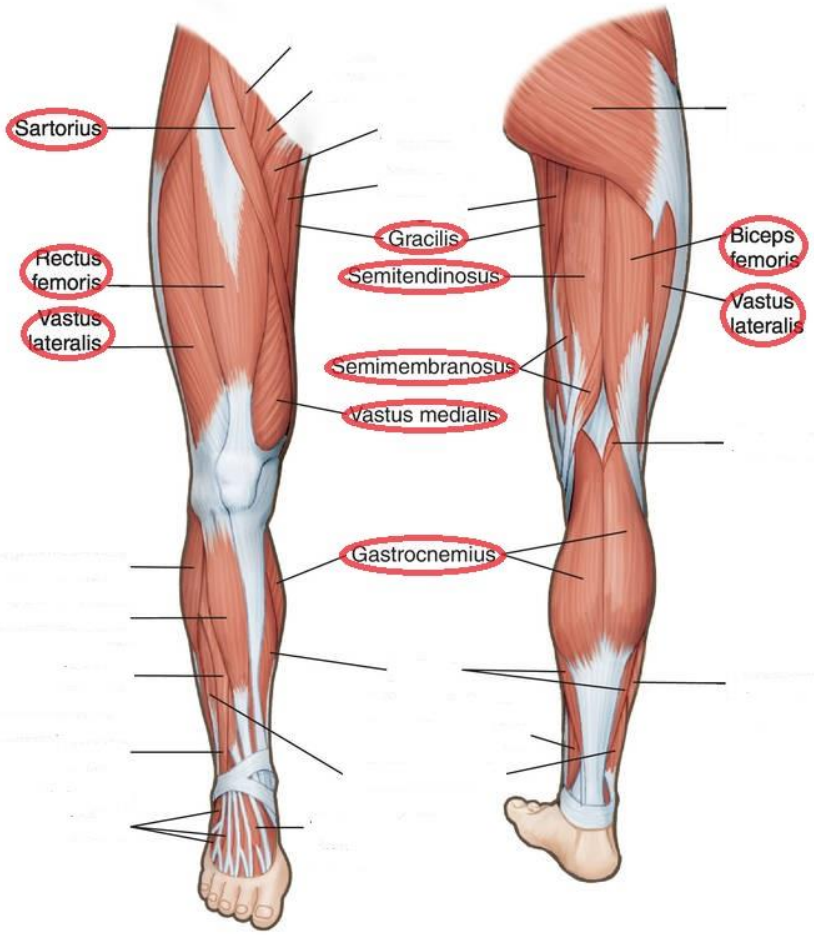

Figure 6 - Muscles related to knee (The Free Dictionary www-page 2016)

The gluteal muscles are also related to knee. It is studied that people who have knee pain tend to also have weaker gluteal muscles than the people who don’t have pain in the knee. (Rowe, Shafer, Kelley, West, Dunning, Smith & Mattson, 2007).

4.2 Biomechanics

Biomechanics observe the mechanics of the human body and its movement. It also helps to understand the triggers leading to musculoskeletal disorders. Biomechanics is founded on physics, chemistry, anatomy and physiology. There are three laws of mechanics named after Sir Isaac Newton. These three Newton's laws are 1. the law of continuity, 2. the law of dynamics and 3. the law of force and counterforce. Newton's 1. law can be examined through an example of what happens when a biker starts to bicycle and maintains constant speed. Firstly the biker needs a lot of energy and power to be able to start the cycling. Through this he can reach the wanted constant speed for example 30km/h. 1. Law of Newton is fulfilled when the biker continues with this speed. 2. Law of Newton can be examined when a biker is starting to cycle and is aiming to reach a certain speed for example 30km/h. When an external power (in this case the power produced by the muscles) is directed to a biker who is still, this power is effecting on the biker's and the bike's mass producing acceleration to the movement. 3. Law of Newton can be examined through the person who is cycling. When the biker is producing force from his muscles to the back tire of the bicycle the tire is pushing the ground backwards. Comparably the ground is pushing the bicycle with the same force but to the opposite direction. (Liikuntapalvelut www-page 2016; Sandström, M. & Ahonen, J. 2011; UKK instituutti www-page 2016.)

There are many factors in the biomechanics that effect on a single performance's property of being challenging. These factors are related to power production and the control of a movement. In the power production these factors are moment, resistance, speed, muscle length and a muscle contraction type. Correspondingly the factors of the control of a movement are base of support, location of center of gravity, the amount of moving parts, symmetry, speed, rhythm and the changes of it, orientation in the space and the planes of movement. (Liikuntapalvelut www-page 2016; Sandström, M. & Ahonen, J. 2011; UKK instituutti www-page 2016.)

During a movement and performance different parts and structures of the human body are in different roles. Some parts and structures have to maintain and produce a wide range of motion and others have to stay tight enough so that the counterforce's moving effect on the center of gravity will not give away and so the structure will

maintain stable. The knee for example is a stable structure. (Liikuntapalvelut www-page 2016; Sandström, M. & Ahonen, J. 2011; UKK instituutti www-page 2016.)

Increased counterforce increases the loading of the joints. The stress of the joints increases when the movement speed of the center of gravity increases. For example in walking the stress of the joints increases 1-1,5 x own body weight. In jogging 2-3 x bw, running 5-6 x bw and triple jump 12 x bw. From sitting to standing patella is compressing to femur 2 x own body weight and this is adding stress to the joint. When squatting the loading is 7-8 x own body weight and 25 x own body weight when jumping on one leg. (Selfe 2014; UKK instituutti www-page 2016)

Useful formula in the biomechanics of the knee joint is the formula of torque. Torque M that is needed in the rotation of a knee is received when multiplying muscle's and rotation's center's perpendicular distance L with muscle's produced force F. Therefore the rotation of a torque is received with a formula M=LF. This formula is presented as a picture in the Figure 7.

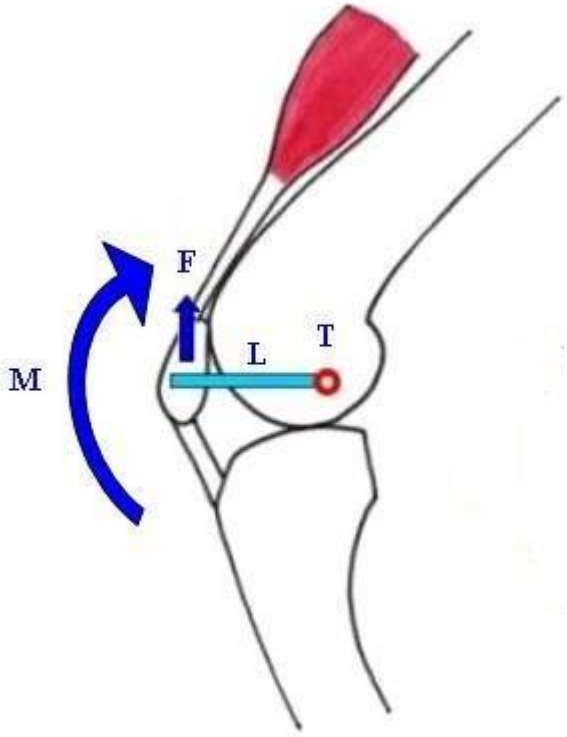

Figure 7 - Knee joint torque, M=FL (Liikuntapalvelut www-page 2016)

4.3 Common knee ligament injuries

In the knee joint there are four ligaments that are prone to injure. These ligaments are posterior cruciate ligament (PCL), lateral collateral ligament (LCL), medial collateral ligament (MCL) and anterior cruciate ligament (ACL). For some reason the ACL ligament is more common to get injured among women than men. (Chiaia, De Mille, 2009.)

Knee ligament injuries can happen in a various ways. It can occur for example when twisting the knee, hit to the knee, extension of the knee for too far, stopping a movement suddenly and a sudden weight shift from leg to another. Often the knee ligament injuries can be rehabilitated conservatively but sometimes they require surgeries. (Chiaia, De Mille, 2009.)

There are ways to prevent knee ligament injuries to some degree but because they happen in an accident it is sometimes impossible. Warming up properly before exercising, strong thigh muscles and good lower extremity strength and flexibility are important key factors in the prevention of injuries. Also improving balance and agility of the lower extremities is necessary. (Chiaia, De Mille 2009.)

5 THERAPEUTIC EXERCISE

From the physiotherapy field therapeutic exercise is the most important area. Therapeutic exercise is rehabilitation of a client with functional and active exercise. With therapeutic exercises the goal is to effect on the physical qualities and possible pain and it focuses on all of the areas of performance and activities of daily living (ADL) of the individual. The aim is also to activate the client's awareness on the rehabilitation process and to increase the commitment. Therapeutic exercising always aims for goals agreed in the beginning with the physical therapist and the client. Types of therapeutic exercise can be for example to increase; muscle strength, range of motion (ROM) of joints, body awareness, body control, motor skills or the capacity of cardio- and respiratory system. In many diseases and traumas therapeutic exercise can increase the functional ability of the client. It is guided by a physiotherapist and the guidance can be manual, verbal or visual or a combination of these. The guidance can be in a group setting or individual during a therapeutic session. The therapist can use different equipment or tools as an assistive aid. Measuring and evaluating the effectiveness and progress is an essential part of therapeutic exercise. (Arokoski, Alaranta, Pohjolainen, Salminen & Viikari-Juntura 2009; Kisner & Colby 2012; Käypähoito www-page, 2016.)

5.1 Types of therapeutic exercises

There are various types of therapeutic exercises that can be applied to a client. The exercises are always applied according to a plan and set goals and they are always directional to the individual and to the individual's needs. The client's diseases and disabilities have to be taken into consideration when planning the exercises. The safety of the client and the physiotherapist is always extremely important and should never be underestimated. The types of therapeutic exercises are aerobic, muscle training, mobility training to the joints and muscles, neuromuscular and body awareness training and body control training. Aerobic training is increasing the health and capacity of cardiorespiratory functions and increasing the fitness level of the individual. Aerobic training increases the heart rate and effects on the blood circulations. It also causes breathlessness. Muscle training can include muscle strength and power

training or for example muscle endurance training. Mobility training to the joints and muscles are techniques and exercises to increase the ROM of the joints and effecting on the muscle length for example with stretching techniques. Neuromuscular and body awareness training consists of proprioceptive training that include static and kinesthetic body awareness. Body control training includes posture control and stabilization training. Balance and dexterous training, relaxation and breathing training and functional training for ADL are also types of therapeutic exercises. (Arokoski, Alaranta, Pohjolainen, Salminen & Viikari-Juntura 2009; Kisner & Colby 2012.)

5.2 Pilates

Pilates was invented by a German man Joseph Hubertus Pilates (1883-1967). Pilates was invented as a body control method which has six certain principles guiding the exercising. These principles are also the factor where the effectiveness is based on. The following are the six principles: focus, control, accuracy, centralization, controlled breathing and flow. (Smith, Kelly & Monks 2004; Suomen Pilatesyhdistys www-page 2016.)

Pilates develops and increases strength, flexibility, endurance, body control and awareness. In Pilates a trainee can learn to use their joints and muscles equally and take loading away from tense muscles. It is also a method used in a rehabilitation of musculoskeletal problems. The point in Pilates is that the movements are performed correctly. To get the best results the trainee needs to focus and concentrate while performing the movements. Pilates is about a series of movements that are performed one after another without breaks forming a flowing wholeness. Pilates is a form of therapeutic exercise that is directed to anyone regardless of their age or fitness capacity. (Smith, Kelly & Monks 2004; Suomen Pilatesyhdistys www-page 2016.)

6 PILATES AND PREVENTION OF KNEE LIGAMENT INJURIES

Training the knee ligaments and the stability of the knee requires training balance, strength, flexibility and stability and in Pilates all of these are fulfilled. The basic idea in Pilates has been core stability and the core is in a big role. Core stability is also related to lower extremity injuries and from the lower extremity injuries core stability has the most impact in particular in the knee. (Chiaia, De Mille, 2009; Smith, Kelly & Monks 2004; Willson, Dougherty, Ireland & Davis, 2005)

It is important to have strong gluteal, thigh and calf muscles when it comes to the knee. Pilates exercises are also good because for example movement done in side-lying with abduction of the legs is the best movement to activate the gluteus medius muscle. One of the best activating exercises for the gluteus maximus muscles is a single-leg squat. (Distefano, Blackburn, Marshall & Padua, 2009.)

The weakness of the gluteus medius and gluteus maximus is involved in the injuries of the lower extremities. For example the weakness in the gluteal muscles is related to anterior cruciate ligament ruptures. In Pilates training and with the right exercises all of these components are taken in to consideration. (Distefano et al. 2009.)

7 THESIS PROCESS

The thesis process started in the fall 2015 with deciding the topic. The topic came up through coaching ringette and from playing history. The area of the topic was interesting and the players at the team always had some musculoskeletal problems although they are youngsters. The whole idea started with the plan of doing something practical and also something that is quite different from the sport-specific training. The thesis method is practice based so it has a written part and a product which in this case is the Pilates training program. During the process the original thesis plan did not quite work so there had to be a new plan made. Here below is the original plan and then also the last, real plan.

Table 1 – Original thesis plan

Fall 2015	Deciding the topic and doing a rough plan.
December 2015	Writing the agreements, getting permissions from the players and the parents. Writing the thesis plan, reading theory.
January 2016	Presenting the thesis. Reading and writing theory.
February 2016	Writing theory.
March 2016	Finishing the thesis and presenting it.

Table 2 – Real thesis plan

Fall 2015	Deciding the topic and doing a rough plan.
December 2015	Writing the agreements, getting permissions from the players and the parents- Writing the thesis plan, reading theory.
January 2016	Presenting the thesis.
September 2016	Reading theory.
October 2016	Reading and writing theory.
November 2016	Finishing the thesis and presenting it.

8 THESIS METHOD (PRACTISE BASED)

Practice based thesis process is one of the used thesis processes of University of Applied sciences'. Practice based thesis process is a type of practice related research. It can be for example event, guidance or instruction. In practice based research there is always a report and a product. The execution can be many different things. It can be for example a booklet, guidance book, webpage, marketing plan, video, portfolio or some other product. (Vilkka, Airaksinen, 2003.)

There are two parts in a practice based thesis process. These two parts are functional or active part and the documenting of the process. There should be a sector of vocational education seen and the text should be research related. The text part in the product should be directional to the target group and the language and the style should be appropriate accordingly. In the consideration should be taken the target group's age and the knowledge of the subject. (Vilkka, Airaksinen, 2003.)

9 PILATES TRAINING PROGRAM

All of the movements in the program are done without any equipment and with bare feet. The movements are done in a flowing series with own body weight. Concentration and breathing are important and especially that the movements are done correctly. The program is performed 3 times a week alongside with sports-specific training and it is continued like that for 6 weeks.

There are five movements in the program. The movements improve the muscle strength of the lower extremities, balance and body control. The first exercise is done standing. Squat and then a jump up and it is repeated for 10 times in a controlled way. The second movement is also done standing but with only one leg. Other leg is flexed and kept in that position actively the whole time. It continues with a one leg squat and then performing a hip flexion and bending over. This is repeated 10 times with both legs. Third exercise is done standing and taking a controlled cross step to back. It is done 10 times with both legs. Fourth movement is extension of the hip on all fours. It is repeated 10 times with both legs. Last exercise is done on side lying with abduction of the hip, kicks to the front and back. Both sides for 10 times.

10 DISCUSSION

The process was started off with a great plan and the plan was graduating earlier than what the official graduation day was. Time passed and a lot was going on and the thesis process delayed. It kept delaying and then the decision had to be made of a new realistic plan. There was struggling with starting the process. The topic was decided and a rough idea but starting to find material and writing the theory was difficult to start. Then when there was no more time to postpone it the working had to start. Towards the end the time kept passing and time was very limited which is very typical for the author. Leaving things to the very last minute and apparently the author wasn't any smarter with this project.

The topic was very interesting and exciting all along. There are very few studies done related to ringette. So for further studies any research related to ringette is beneficial but furthermore what sort of training would be most beneficial related to prevention of knee ligament injuries in ringette.

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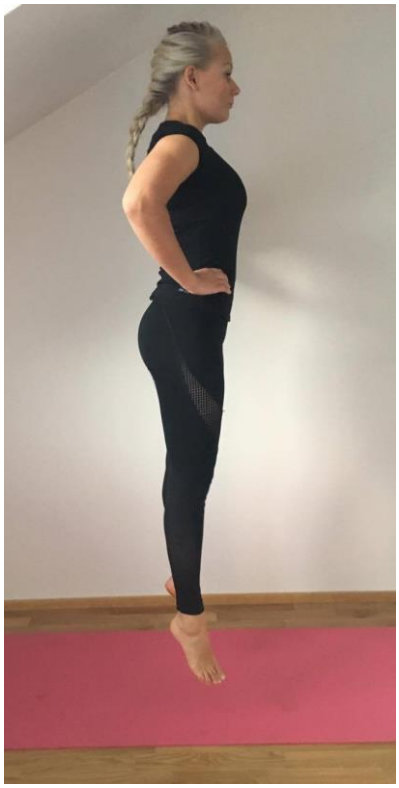
APPENDICES

Hyppy ylös

– Seiso tukevasti molemmilla jaloilla ja aktivoi keskivartalo
– Sisäänhengityksellä kyykisty ja pidä polvet varpaiden kanssa samassa linjassa



-Uloshengityksellä hyppää ylös kontrolloidusti
-Alastullessa, koukista polvet ja ponnista uuteen hyppyyn
-Toista liikettä 10 kertaa

Huomioitavaa: Katso, että jalkojen linjaus säilyy koko ajan. Pidä myös keskivartalo tiukkana koko sarjan ajan. Pehmennä hypyn alastuloa koukistamalla polvia.

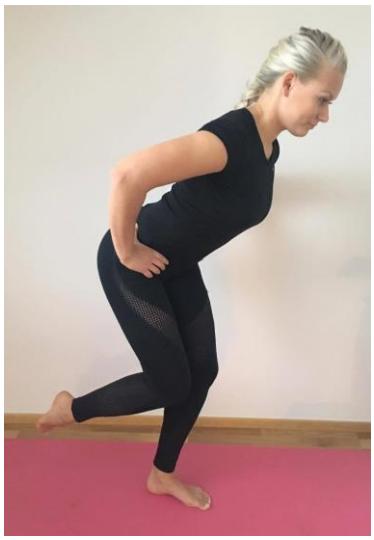
Vaikutus: Vahvistaa pohje-, reisi ja pakaralihaksia, sekä parantaa keskivartalon hallintaa.

Lattian pyyhintä

- Seiso tukevasti yhdellä jalalla, toinen jalka aktiivisesti koukussa
- Pidä keskivartalo aktiivisena ja pidä paino tasaisesti koko jalkapohjassa

- Lähde koukistamaan tukijalan polvea kontrolloidusti
- Koukista jalkaa niin paljon kuin pystyt
- Säilytä polvi-varvaslinja koko liikkeen ajan

Huomioitavaa: Katso, että lantio pysyy koko ajan suorassa linjassa, eli pakaralihakset ovat aktiiviset ja lantio ei ”tipahda”. Huomioi myös jalan linjaus, että se säilyy koko liikkeen ajan.



- Kun polvi on koukistettu pidä asento ja hitaasti taivuta ylävartaloa kohti lattiaa
- Palaa alkuasentoon ensin suoristamalla keskivartalo ja sen jälkeen rauhallisesti koko jalka
- Toista liike 10 kertaa molemmilla jaloilla

Vaikutus: Kehittää tasapainoa, sekä kehonhallintaa. Vahvistaa reisi- ja pakaralihaksia sekä harjoittaa myös keskivartalon lihaskestävyyttä ja nilkan voimaa.

Ristiaskel

-Seiso tukevasti molemmilla jaloilla, noin lantion leveydellä
-Pidä keskivartalo aktiivisena ja nosta kädet olkapäiden jatkoiksi
-Hengitä nenän kautta sisään

-Uloshengityksellä ota askel takaviistoon ja pidä tukijalka paikallaan
-Pidä molemmat jalat koukistettuna ja säilytä asento noin kolmen sekunnin ajan
-Sisäänhengityksellä palaa alkuasentoon
-Toista liikettä molemmilla jaloilla 10 kertaa

Huomioitavaa: Pidä hartiat rentoina ja keskivartalo tiukkana. Muista tehdä liike hallitusti.

Vaikutus: Vahvistaa reisi- ja pakarali-haksia sekä parantaa kehonhallintaa

Jalan ojennus taakse

-Konttausasennossa, polvet lantion alla ja kämmenet hartioiden alla.

-Aktivoi keskivartalo ja säilytä selän luonnolliset kaaret

-Sisäänhengitä

-Aktivoi pakara ja uloshengityksellä ojenna jalka suoraksi taakse. Säilytä keskivartalon ja pakaran aktivaatio koko liikkeen ajan.

-Sisäänhengityksellä palauta jalka tukijalan viereen

-Tee liike 10 kertaa molemmilla jaloilla

Huomioitavaa: Säilytä selän hyvä asento koko liikkeen ajan.

Vaikutus: Parantaa pakaralihasten aktivointia ja vahvistaa niitä sekä reisilihaksia. Vahvistaa myös keskivartalon lihaksia sekä kehonhallintaa.

Potkut

-Kylkimakuulla, vartalo suorassa

-Aktivoi keskivartalo sekä pakarat ja säilytä asento

-Tue toisella kädellä päätä ja aseta toinen käsi matolle, vatsan eteen

-Uloshengityksellä nosta jalka ylös matosta ja vie hallitusti niin pitkälle eteen kuin pystyt

-Sisään hengitä ja palauta jalka keskelle

-Uloshengityksellä potkaise jalka kontrolloidusti taakse

-Säilytä hyvä asento ja pysy suorassa linjassa

-Sisäänhengityksellä palaa alkuasentoon

-Toista koko liikesarja molemmin puolin 10 kertaa

Huomioitavaa: Pidä huoli, ettei vartalo kallistu eteen tai taakse. Pidä ylemmän jalan nilkka aktiivisesti ojennettuna.

Vaikutus: Parantaa kehonhallintaa ja tasapainoa. Vahvistaa pohje-, reisi- ja pakaralihaksia.

Polven nivelsiteiden vauriot ovat yleisimpiä vaurioita naispelaajilla sekä ringetessä, että jääkiekossa. Pilates liikkeet on valittu vastapainoksi muulle ringetteen liittyvälle harjoittelulle. Ne ovat hidastempoisia ja niissä korostuu liikkeiden hallinta ja keskittyminen. Ne parantavat kehonhallintaa, tasapainoa ja voimaa. Liikkeet vahvistavat pakara-, reisi-, pohje- ja keskivartalon lihaksia, jotka ovat tärkeitä polvinivelen nivelsiteiden vaurioiden ennaltaehkäisemiseen.

Liikkeet on valittu siten, että ne ovat haastavuudeltaan tarpeeksi vaativia. Liikkeet ovat myös oikeanlaisia juuri polven nivelsiteiden ja lihasten harjoittamisen kannalta, jotta polvet pysyvät terveinä ja vahvoina sekä kestävät niiltä vaadittavat kuormitukset.

Suorita liikkeet rauhallisesti ja keskity samanaikaisesti myös omaan hengitykseen. Harjoittelun pointti on keskittyminen ja liikkeiden oikein suorittaminen. Väärin tehtynä eivät ne aja samaa asiaa ja tarkoitusta, eikä haluttuja tuloksia saavuteta. Jokaista suoritusta tehdessäsi, varmista, että keskivartalosi on aktiivinen ja hyvässä asennossa, ja että jalkojen linjaukset pysyvät.

Tee koko harjoitusohjelma 3x viikossa, 6 viikon ajan.