Satakunnan ammattikorkeakoulu
Satakunta University of Applied Sciences

SENAN FREYNE

# Knee Meniscus Tear – Surgical vs Conservative Treatment

Systematised Literature Review

DEGREE PROGRAMME IN PHYSIOTHERAPY
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The aim of this thesis was to increase the evidence-based knowledge concerning the topic of the differences in effectiveness in both conservative and surgical treatments of meniscal tears in the knee joint. The objective was to investigate and compare the results of these two different approaches by means of a systematised literature review.

A systematised literature review was undertaken to gather evidence on the topic. This type of review loosely followed the strict guidelines of a systematic literature review but only had one author and used one database as its research source. Research which passed through the eligibility criteria from the database PubMed was included. They were then assessed on the PEDro scale and those approved were used in the thesis.

The results showed encouraging evidence that conservative treatment may be considered a viable alternative to surgical treatment in the case of degenerative and non-obstructive meniscal tears. Positive findings among various outcome measures deduce that conservative treatment cannot be seen as inferior to surgical in the long-term. In some factors such as cost effectiveness and thigh muscle strength in the long-term results, conservative treatment is proven to be superior to surgical.

Historically, meniscal surgery has been seen as the main form of treatment for meniscal pathologies, while the surgery has advanced to arthroscopic level there is progressive research showing conservative therapy can play a role in the treatment of meniscal tears. Further research is imperative; however, it can be seen in this thesis, the effectiveness of conservative treatment with certain types of meniscus tear.



Key words
Meniscus tear, meniscal tear, conservative, surgical, operative, versus, compared

CONTENTS

# 1 INTRODUCTION

Though in the past referred to as a functionless remnant of the embryo (Bland-Sutton, 1897), the menisci are now understood to be a vital component of the knee joint regarding normal function and long-term health. In addition to increasing the stability of the joint and acting as a shock absorber, the menisci also assist in the lubrication and supply of nourishment to the knee joint (Fox et al., 2012).

The incidence of meniscal injuries is on the rise in recent years, and this may be partly attributed to a population which is increased participation in sports and in the advances and easy availability of imaging technologies such as MRI (Chambers & Chambers, 2019).

Surgical management has seen advances since the 1970's and is still the more popular method of treatment for tears to the meniscus, however in cases of smaller and more stable tears or when the lesion is located within the high vascularity zone of the meniscus, conservative management has been seen as successful (Giuliani et al., 2011).

In this thesis I plan to explore more into the distinct aspects of meniscal tears and compare the treatments of surgical and conservative regarding short-term results, long-term results, and cost effectiveness.

# 2 ANATOMY OF THE KNEE

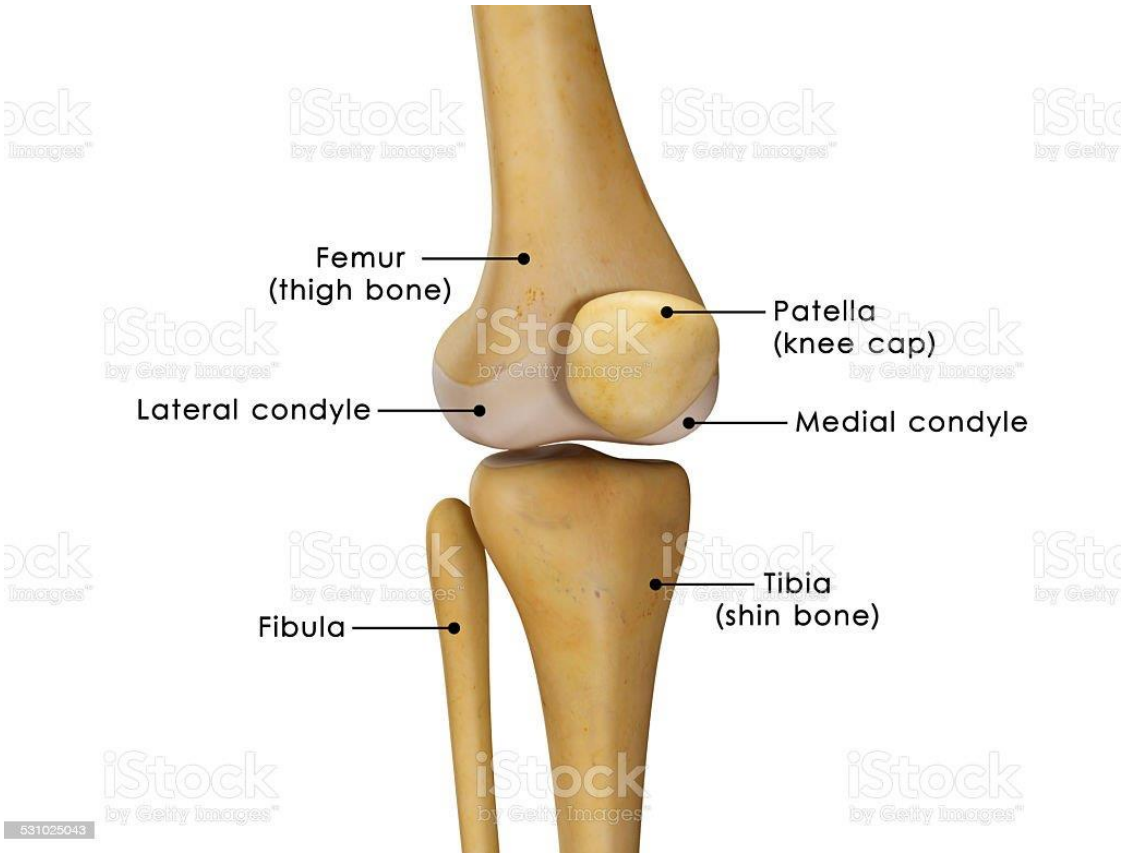
## 2.1 Overview

The tibiofemoral joint or knee joint is the largest and most complex joint in the body. It is a modified hinge joint with about 2° of freedom and its primary movement is a uniaxial hinge movement. It consists of three joints within a single synovial cavity - two tibiofemoral joints: one between the medial condyle of the tibia, the medial meniscus, and the medial condyle of the femur. One between the lateral condyle of the tibia, the lateral meniscus and the lateral condyle of the femur, and the patellofemoral joint which lies intermediate to the others and is between the patella and the trochlea or patellar surface of femur. (Magee 2014, 765.)

## 2.2 Bones of the Knee Joint

The distal portion of the femur, proximal portion of the tibia and patella articulate through these aforementioned joints. The bones are surrounded by a smooth yet tough articular cartilage which ensures friction free movement and gliding in the joint. The fibula attaches to the tibia at the superior tibiofibular joint and provides an attachment surface for muscles and ligaments, however it is not directly involved in the knee joint. (website of sportsinjuryclinic, 2016.)

The patella is a large, flat triangular bone which is the largest sesamoid bone (a bone which is embedded in a tendon or joint capsule) in the body. It provides an attachment point for the quadriceps tendon and has several functions including its role as an articulating component of the extensor mechanism of the knee and guiding the forces of the quadriceps muscles to the patellar tendon. It also provides some stability to the knee joint and protects the deep knee joint anatomy. (Fox et al., 2012.) Picture 1 demonstrates the bony structures of the knee joint.




Picture 1. Bony Structures of Knee Joint (The Knee Joint Joins the Thigh with the Leg and Consists of Two, n.d.)

The knee has several anatomical components which lie either within or outside the joint capsule. The articular capsule itself consists of a ligamentous sheath made of mostly muscular tendons and also capsular fibers which connect articulating bones. (Tortora & Derrickson 2017, 247.)

## 2.3 Ligaments of the Knee Joint

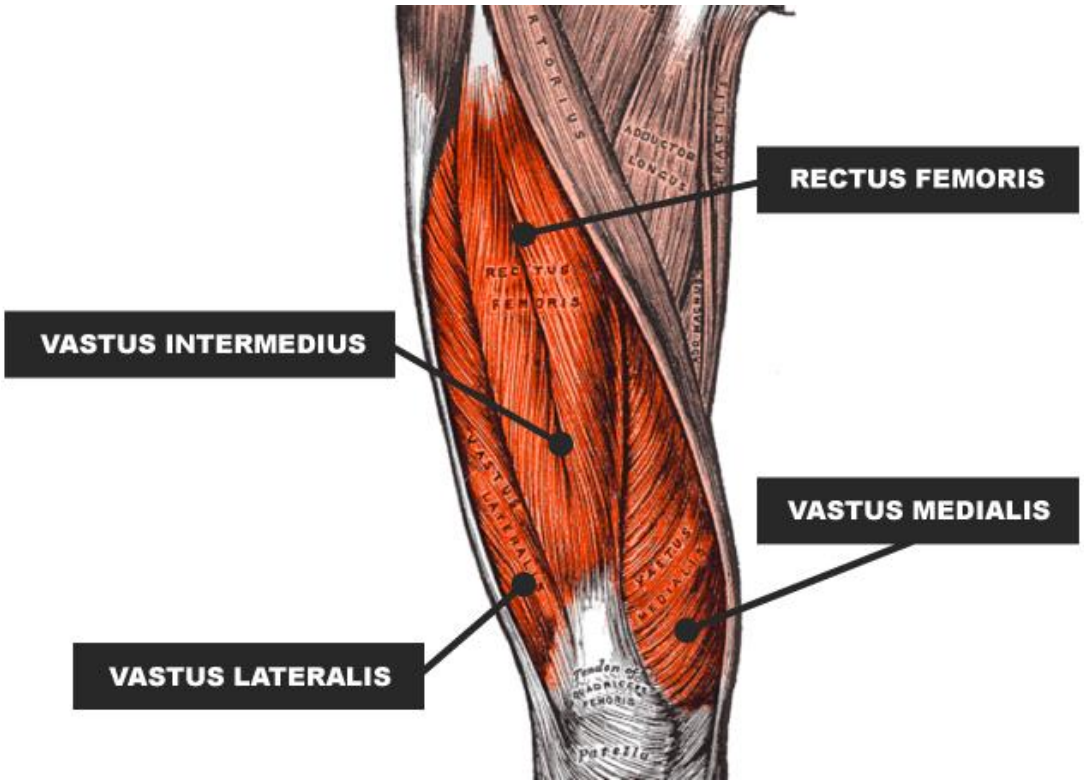
The joint capsules fibrous layers alongside the capsular ligaments enhance the stability of the knee. Within the capsule lies the synovial membrane which nourishes the intracapsular structures by producing synovial fluid which acts as the natural lubricant of the knee joint. The extracapsular ligaments of the knee lie outside of the joint capsule and include the patellar ligament, the lateral and medial collateral ligaments, and the oblique and arcuate popliteal ligaments. Their function is to provide knee

stability in anterior, posterior, medial and lateral portions of the joint and to connect the femur and tibia. (Tortora & Derrickson 2017, 247-248.)

The intracapsular structures consist of the anterior cruciate ligament, which prevents hyperextension and excessive anterior glide of the tibia, the posterior cruciate ligament which prevents excessive posterior glide of the tibia and the medial and lateral menisci which will be discussed further later in this thesis (Tortora & Derrickson 2017, 248-250).

## 2.4 Muscles Surrounding the Knee Joint

The main movement of the knee is flexion and extension, the knee acts as a hinge joint and the articular surfaces of the femur glide over the surface of the tibia. The muscles of the anterior thigh, also known as extensors or quadriceps, function as the primary extensors of the knee. These consist of rectus femoris, vastus lateralis, vastus intermedius and vastus medialis and are illustrated in picture 2. All but rectus femoris originate on the femur and so rectus femoris is the only one which crosses both hip and knee joints as it originates on the iliac spine. They insert to the patella via quadriceps tendon which in turn attaches to tibial tuberosity via patellar tendon. (Tortora & Derrickson 2017, 341.) In knee flexion and extension the tibia and patella function as a single structure relative to the femur (Ombregt 2013, 262-269).




Picture 2. Quadricep Muscles (Quadriceps Injury: Comprehensive Recovery Guide | Rugbystore Blog, n.d.)

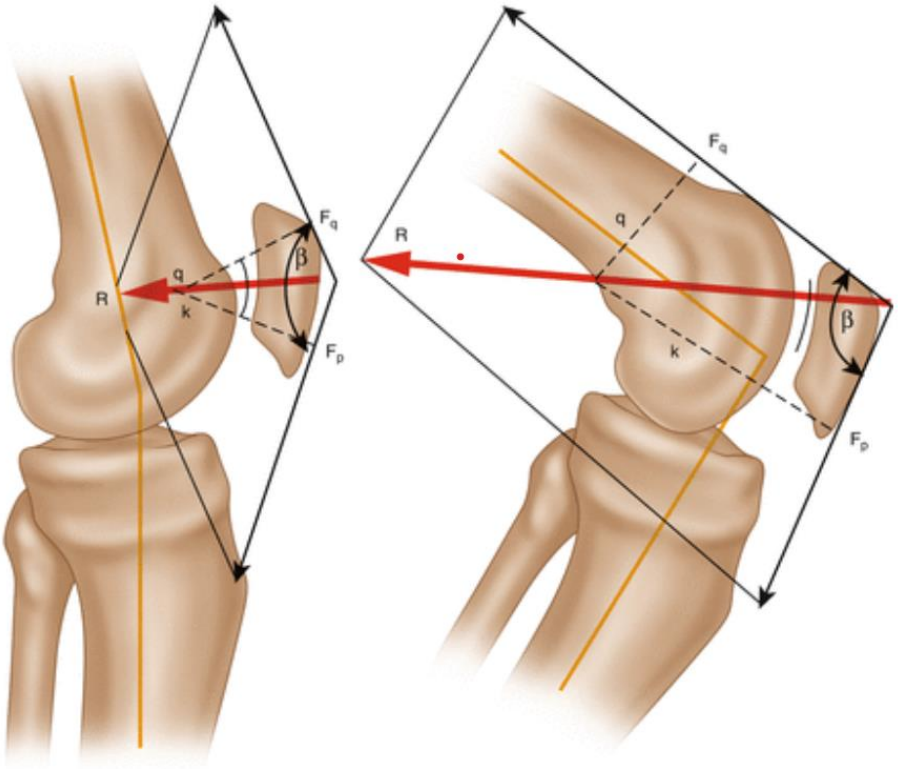
The muscles of the posterior compartment of the thigh can be viewed in picture 3. They are the hamstring muscles, and they function as the primary flexors of the knee. The hamstring muscles consist of biceps femoris (long and short heads) semitendinosus and semimembranosus which all originate from the ischial tuberosity except for the short head of biceps femoris which arises from the femur. The biceps femoris muscle is located posterolateral and such attaches to the lateral tibial condyle and head of fibula, whereas the posteromedial semitendinosus and semimembranosus attach to the medial surface of tibia and medial condyle of tibia respectively. (Tortora & Derrickson 2017, 341.)


Picture 3. Hamstring muscles (Hamstring Muscle Injuries - OrthoInfo - AAOS, 2015)

## 2.5 Knee Biomechanics and Kinesiology

The tibiofemoral joint acts as a junction between the two longest bones in the body and has the quadriceps, the strongest muscles in the body, crossing it. Its simplest description would be a hinge joint acting in the sagittal plane. Range of motion commonly goes from 0° flexion (or full extension) to 130° flexion through hamstring contraction and may reach up to 160° with passive flexion. Negative flexion or hyperextension of up to -5° can be seen in some individuals. (Masouros, 2010.)

The patellofemoral joint can be exposed to high compression forces. This joint acts in increasing the lever arm of the extensor mechanism to ensure full extension forces are possible. The compression force increases in knee flexion and is at its greatest at 60° - 90° flexion. As demonstrated in picture 4, at this angle you will also find the maximum contact area between patella and femur to protect the joint from these high compression forces. (Neumann, 2010.)




Picture 4. Patellofemoral compression forces in flexion (website of musculoskeletalkey, 2017)

The patellofemoral joint uses a combination of anterior knee ligaments such as the medial patellofemoral and patellomeniscal ligaments, and the quadricep muscles to both passively and dynamically stabilise the patella and resist lateral subluxation (Website of Orthobullets, 2021). An intricate series of afferent nerves will use mechanoreceptors to record several components associated with overloading the knee joint. These assist in the maintenance of joint stability as they regulate and control the motion against internal and external disturbances. (Solomonow & Krogsgaard, 2001.)

In the tibiofemoral joint, the joint reaction forces which act across it during a normal gait cycle can be between 2-3 times the body weight, and in the cases of malalignment,

a slight 3° to 5° angle of varus in the tibia can increase the force across the medial tibiofemoral compartment of up to 50% (D'Lima et al., 2012). Due to the medial tibial plateau surface being longer than the lateral tibial plateau surface, the tibia externally rotates during the last 15° of extension. This is known as the screw home mechanism and can be considered a key element knee stability when standing upright and this locked position reduces workload of quadriceps in standing. (Screw-Home Mechanism - OrthopaedicsOne Articles - OrthopaedicsOne, n.d.)

# 3 MENISCUS OF THE KNEE

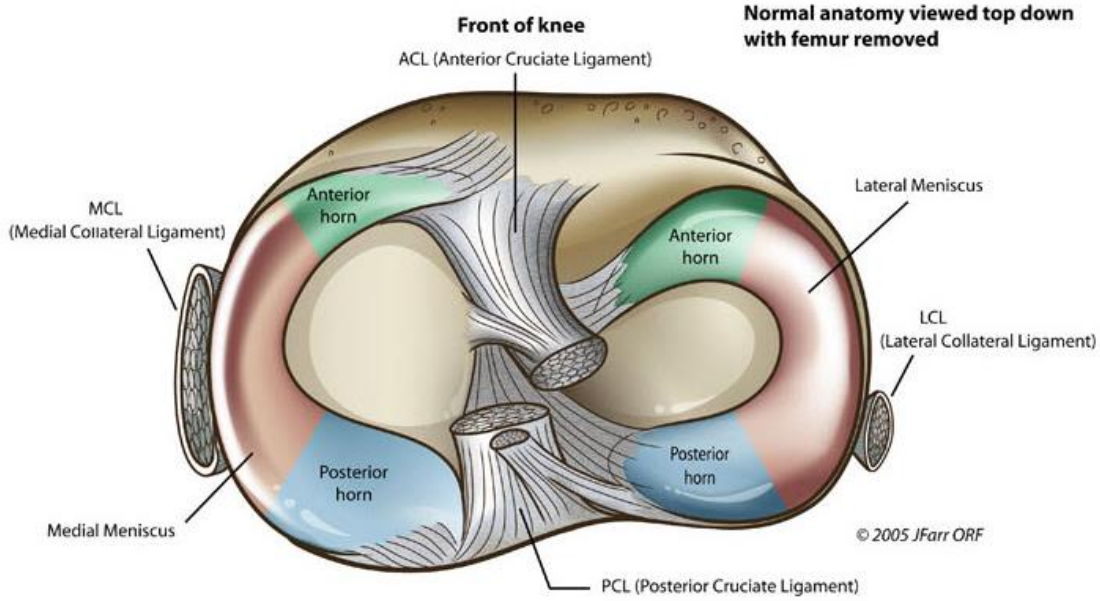
## 3.1 Anatomy and Physiology

The word meniscus comes from the Greek word 'meniskos' which means crescent, due to their shape. The knee joint contains two menisci, medial and lateral, which are two crescent shaped wedges of fibrocartilage which lie on the medial and lateral tibial plateaus respectively and form the concavity in which the femoral condyles can sit. From a two-dimensional view the menisci can be seen as wedge shaped, the outside or peripheral portion is thicker and better vascularized and attaches to the joint capsule while the inner portion is thinner and has a poorer blood supply. (Fox et al., 2012.)

The medial meniscus is C shaped and covers about 60% of the medial tibial plateau. Its posterior segment, known as the posterior horn, is significantly wider than the anterior segment, known as the anterior horn. There is a variability on the attachment site of the anterior horn but usually it lies anterior to the anterior cruciate ligament. The posterior horn attaches to the posterior intercondylar fossa. The medial meniscus is attached to the tibia via the coronary ligament. (Fox et al., 2014.)

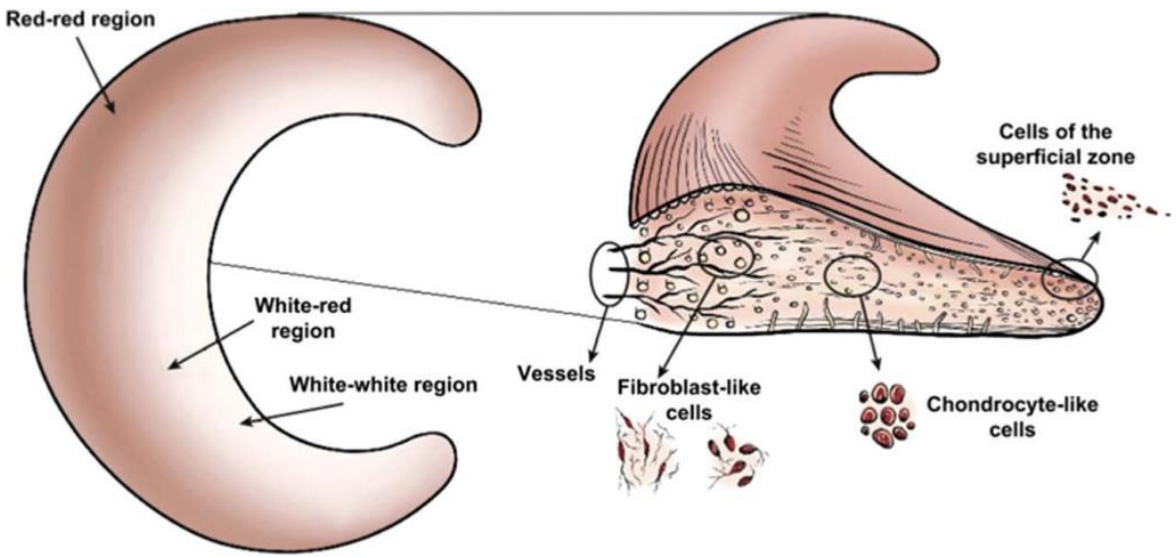
The lateral meniscus is more of a circular shape and covers about 80% of the lateral tibial plateau. The anterior horn is attached to the intercondylar fossa and the posterior horn is attached to the posterior cruciate ligament and to the medial femoral condyle

via meniscofemoral ligaments of Wrisberg and Humphrey. (Fox et al., 2014.) Picture 5 below shows both menisci and their sections from a superior view and also shows some ligaments within the joint capsule.




Picture 5. Superior view of a cross section of a right knee. (Singh, 2021)

The menisci suffer from poor vascularization with only the peripheral 10%–30% of the medial meniscus and 10%-25% of the lateral meniscus receiving a blood supply. The main blood supply comes from branches of the popliteal artery. The remaining portion of the menisci receive nourishment from synovial fluid during mechanical motion. (Fox et al., 2014.) In picture six below, the red-red region refers to the vascular region, the white-white region refers to the avascular region and the white-red region refers to the in between region (Makris et al., 2011).




Picture 6. Sagittal cross section of meniscus showing vascularization (Makris et al., 2011)

## 3.2 Role of Menisci

The primary role of the menisci is the involvement in load transmission across the knee joint and to reduce contact pressures between the femur and tibia. As the angle of flexion increases the percentage of the load taken by the menisci increases and to allow for less pressure on the bones. The menisci also ensure adequate joint conformity and congruency between tibial and femoral condyles by deforming in flexion and extension to allow normal circulation of the lubricating synovial fluid within the joint. (Bryceland et al., 2017.)

The menisci also play a role in stabilization and shock absorption. The stability function is seen in the case of ACL deficient knees where in knees with an absence of a functional medial meniscus there can be up to 58% of increased anterior tibial translation compared to those which suffer solely from an ACL tear. (Markes et al., 2020.)

Inability to successfully absorb shock has been noted in the development of osteoarthritis, showing a good shock absorption system plays a significant role in a healthy knee joint (Radlin & Rose, 1986). A study by Voloshin and Wosk found that a knee which has undergone meniscectomy may have up to 20% of a deficit in shock absorbing capacity when compared to a healthy knee (Voloshin & Wosk, 1983).

## 3.3 Types of Tears

The patterns of rupture include longitudinal, radial, oblique, complex, horizontal and bucket handle. Longitudinal tears run vertically, parallel to the long axis of the meniscus and may be complete or incomplete, the 'complete' longitudinal tears are known as bucket handle tears (due to their appearance), as illustrated in picture 7, and can cause a mechanical locking of the knee in addition to instability. (Maffulli, 2010.)

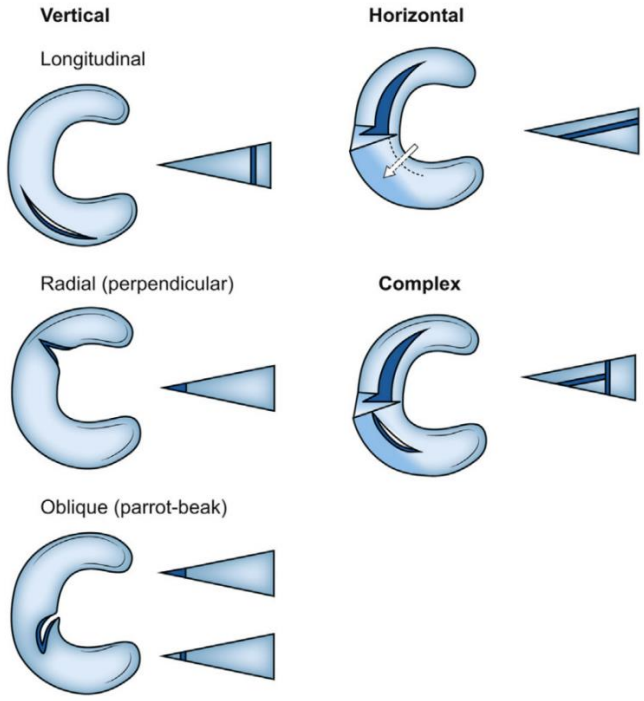

Picture 7. Incomplete and complete longitudinal tear in meniscus. (Meniscus Tear Wiki, n.d.)

A radial tear runs perpendicular to the long axis of the meniscus and is a vertical tear, it begins at the inner side of the meniscus and continues towards the joint capsule. These tears are usually found in the posterior and middle third of the medial meniscus and near the posterior site of insertion on the lateral meniscus. Radial tears effect on the tibiofemoral load transmission and on the ability to tolerate weight bearing contact stresses. (Tuckman et al., 1994.)

Oblique tears are called so due to the oblique angle in which the tear takes place, they may lead to a flap being formed and so may also be known as flap tears. The flap may move into and out of its correct position and may ‘catch’ in the joint during flexion when it is displaced causing a worsening of the tear and a mechanical obstruction in the joint capsule. (Mordecai, 2014.)

Horizontal tears run in the horizontal plane, parallel to the tibial plateau, and split the meniscus into an upper and lower part. They can lead to spaces for synovial fluid to leak into and not be able to flow back out of due to the lack of space, this can lead to local swelling and meniscal cysts. (Maffulli, 2010.)

Complex tears, also known as degenerative tears, include multiple tear patterns and are commonly associated with degenerative changes in the articular cartilage. They are mostly found in the posterior and midportion segments of the menisci. (Maffulli, 2010.) Some types of tears are shown below in a simplistic view in picture 8.




Picture 8. Meniscal tears and how they appear in cross sectional sagittal plane. (Lecouvet et al., 2018)

## 3.4 Clinical Presentation

Meniscal tears can cause a range of symptoms: pain, often localised to the joint lines, swelling, locking, clicking and the feeling of instability that the knee will ‘give way.’ In the cases of traumatic lesions, the patient may recall a significant event from which the pain began, such as a sharp turn or twisting mechanism on a semi-flexed knee weight bearing knee. In degenerative lesions, the pain may have come slowly over time and there may also be degeneration present in the articular cartilage of the joint and behind the patella. In some cases, a medial meniscal tear may wake the patient in their sleep due to the knee colliding off the other as they roll over. (Bhan, 2020.)

Joint line tenderness, in specific tests and in palpation, a popping sound on mechanism of injury and excessive hyper-flexion of the knee while weight bearing leading to excessive pressure on the knee joint is also consistent with meniscal tears (Lee et al., 2014). It should be noted that the ‘popping’ sensation, when accompanied by immediate buildup of fluid, may be indicative of an ACL rupture with an accompanying meniscal tear. If the effusion comes more gradually, over the course of the following day, it would be indicative of an isolated meniscal tear with no damage to the ACL. (Raj & Bubnis, 2022.)

## 3.5 Risk Factors

Snoeker et al. in 2013, compiled a meta-analysis of 11 studies containing 7358 participants suffering from meniscal lesions and results showed convincing evidence that age (being older than 60 years, gender (being male), work related kneeling and squatting and climbing stairs (more than 30 flights) were strong risk factors for degenerative meniscal tears. There was also compelling evidence that playing field sports such as football and rugby were linked to acute or traumatic meniscal tears and waiting for more than a year for ACL reconstructive surgery after the date of injury is consistent with being a risk factor for medial meniscal tears. (Snoeker et al., 2013.)

A study by Haviv et al. in 2015 has shown a correlation between middle-aged patients with a higher BMI and the presence of more advanced meniscal lesions when an

arthroscopy is performed after unremarkable radiographs (Haviv et al., 2015). Patients with a higher BMI (>26) may also have significantly worse short-term outcomes following an arthroscopic meniscectomy when compared to non-obese patients (Erdil et al., 2013).

### 3.6 Prevalence

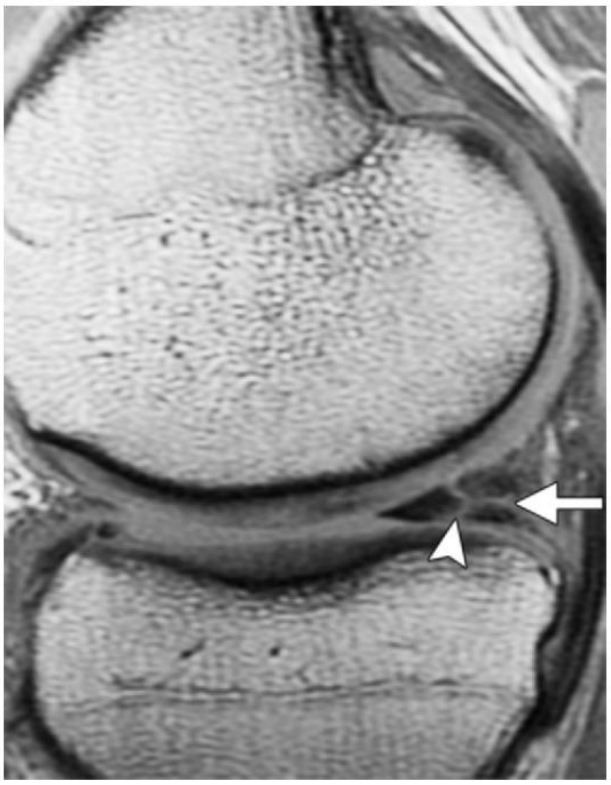
Meniscal tears are an issue that are commonly seen worldwide. In Great Britain, particularly England and Wales, meniscal tears are responsible for around 25 000 admissions to hospitals every year (Baker et al., 2002). In the United States, an arthroscopic meniscal procedure following a meniscal tear is the most frequently performed orthopaedic surgical procedure (Englund et al., 2008). Knee meniscal tears have an incidence of 61 cases per 100 000 people and the ration of men to women between 2.5:1 to 4:1 (Micheo, 2013). There is a high prevalence of between 22% - 86% linking the chance of a meniscal tear when an injury is sustained to the ACL (Logerstedt et al., 2010).

## 4 DIAGNOSTIC PROCEDURES

### 4.1 Medical Imaging

Magnetic Resonance Imaging (MRI) is the preferred method of screening for meniscal tears due to its prominent level of accuracy, speed, and avoidance of surgery. It has a sensitivity of about 95% and a specificity of 81% for medial meniscus tears and a sensitivity of about 85% and a specificity of 93% for lateral meniscus tears. (De Smet, 2012.) With the clear positive diagnostic performance of MRI there is less prevalence of diagnostic arthroscopic surgery used to identify meniscal tears as it avoids the

surgical risks of arthroscopy (Crawford et al., 2007). A complex tear in the meniscus is displayed in the MRI shown in picture 9.



Picture 9. MRI in sagittal plane with arrows showing a complex tear (Nguyen et al., 2014)

Computed Tomography (CT) is preferably used for diagnosis or assessment of suspected fractures, although some ligament injuries may be visible on CT scans it is uncommon to use this as a favoured method to MRI (Naraghi & White, 2016).

## 4.2 Outcome Measures

A study by Wang et al. in 2010 found several patient-based measures, including the International Knee Documentation Committee (IKDC), the Knee Injury and Osteoarthritis Outcome Score (KOOS), the Western Ontario Meniscal Evaluation Tool (WOMET), the Cincinnati Knee Rating System and the Lysholm Knee Score and found after rigorous evaluation these showed acceptable psychometric properties. However, none have been found to be universally applicable and it should be up to the

clinician to make the best selection when taking into consideration the specifics of this patient. (Wang et al., 2010.)

## 4.3 Physical Examination

An evidence based physical examination, in junction with an effective subjective history should be used to correctly identify meniscal pathology. Patient past medical and surgical history, history of present condition and previous treatments sought by the patient should be noted and used to guide your objective examination. (Magee, 2014.)

In the objective phase, a visual inspection should be undertaken of the patient, with a comparison throughout between unaffected and affected legs. Observation of their height, weight, knee alignment and gait in standing and walking is important. Around the knee joint should also be observed for any discolouration, effusion, atrophy, and integrity of the skin. (Hoppenfeld & Hutton, 2019.)

During palpation there may be a reproduction of pain or discomfort felt along the medial or lateral joint lines. During the ROM observation, the patient may struggle to get to full extension due to a mechanical obstruction or pain, and when at max flexion and extension there may be pain when overpressure is applied by the examiner. It also should be kept in mind to check and clear other components of the kinetic chain to rule out their involvement in the knee pain. (Magee, 2014.)

## 4.4 Special Tests

The McMurray test is a test conducted to identify the presence of meniscal lesions. The test is done with the patient in supine and the knee in full flexion, to assess the lateral meniscus the knee should be internally rotated and then brought to extension at various angles of knee flexion to ensure the whole posterior aspect is evaluated. To

evaluate the medial meniscus the knee should be brought into external rotation and repeat the same as for lateral meniscus. A positive test can be seen if pain or popping is elicited. Blythe et al. in 2015 found the diagnostic accuracy of the McMurray test to be as low as 54% and said this was too low to be used for clinical value as an alternative to MRI. (Blyth et al., 2015.)

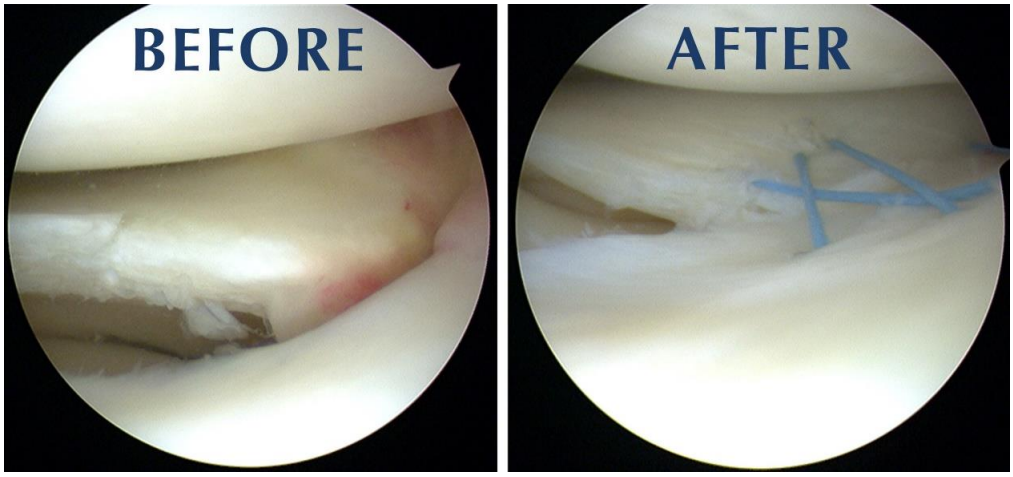
The Thessaly test is also done to identify the presence of meniscal lesions. The test is done with the patient in standing single leg on the affected side and the knee in 20° with the patient holding the examiners arm for support. The patient then rotates three times on each side. Pain along the joint lines indicates a positive test. The Thessaly test had been described in the past as the most accurate test for meniscal lesions. (Karachalios et al., 2005.) However a study in 2015 examining the validity of the Thessaly test found that it did not seem useful to identify the presence or absence of meniscal lesions (Goossens et al., 2015).

# 5 SURGICAL TREATMENT

## 5.1 Overview

The surgical treatment for a torn meniscus is most commonly performed arthroscopically. A meniscal repair may be favoured if the tear lies a portion of the meniscus with adequate vascularization (as shown in picture 10), however if this is not possible, a meniscal removal or meniscectomy, either partial or full, may be performed. This can vary from trimming frayed edges to removing the entire meniscus. (McKeon et al., 2009.) Meniscal repair is the most frequent cause of surgical procedures performed by orthopaedic surgeons with an annual incidence of meniscal tear being 0.066%. The incidence is higher in males in both cases of isolated meniscal repair (59.5%) and concomitant meniscal and ACL repair (60%). (Majewski et al., 2006.)

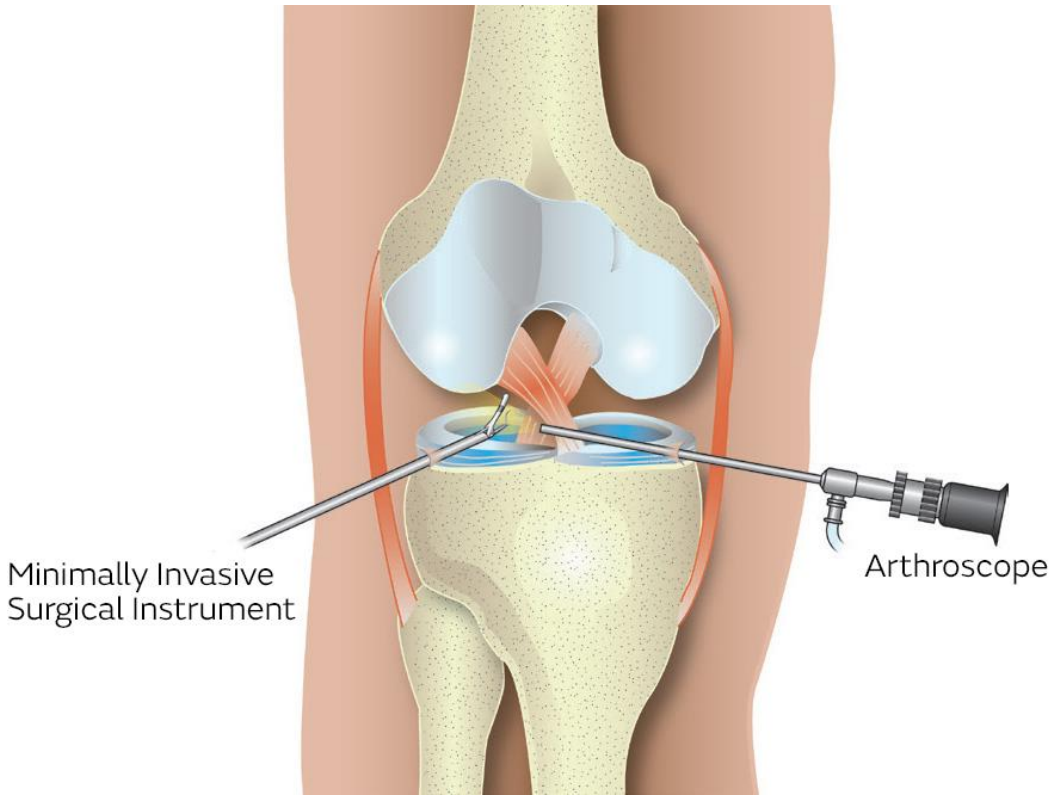
The main goal of surgery of the meniscus is to preserve as much healthy tissue as possible (Heckmann et al., 2006). As only the outside portions of menisci are vascularised, and a good blood supply is essential to healing, repairs are usually limited to this section of the meniscus. For all the tears which occur in the core areas with no blood supply, a meniscectomy is preferred. (Arthroscopic Meniscus Repair, 2013.)




Picture 10. Before & after of a lateral meniscus repair. (Tear, 2021)

## 5.2 Procedure

The arthroscopic procedure commonly takes between 30 - 60 minutes and involves two (or sometimes more) small cuts or portals (as shown in picture 11) made under the patella which serve as the entry points for the arthroscope and the other surgical equipment. The knee will be pumped with a sterile fluid to expand the joint space allowing the surgeon to see better. The surgeon will then be able to find the tear and decide, based on its location and severity, whether a repair or meniscectomy is most appropriate. (Meniscus Surgery: Who Needs It, What to Expect before & After, 2021.)




Picture 11. Animation showing arthroscopic portals and tools. (All Tears, All Repairs, 2013)

## 5.3 Post-Op Care

It is recommended to have supervised rehabilitation sessions as part of the short and long-term follow ups following the surgery (Makris et al., 2011). Patients can expect to return to work within 2 weeks of surgery if their work is sedentary, return to sport within 6 weeks and competitive sports within 8 weeks (Frizziero et al., 2013).

In cases of meniscectomy, there is a direct correlation between the percentage of meniscus removed and an increase in peak stresses on tibial plateau. The load distribution function can be disrupted if the peripheral aspect of the meniscus is cut through during the surgery. (Hoser et al., 2001.) Research from Faucett et al. in 2018 comparing long term effectiveness of meniscal repairs and meniscectomies found meniscectomy led to significantly higher rates of osteoarthritis and higher rates of total knee replacement over the duration of 10 years. In addition, meniscal repair was seen to be more cost effective. (Faucett et al., 2018.)

# 6 CONSERVATIVE TREATMENT

## 6.1 Physiotherapy Management

Physiotherapy intervention may introduce exercise therapy with the aim of reducing pain and improving knee joint function through the maintenance of range of motion, increasing hip and hamstring flexibility and increasing quadriceps strength (Howell, 2014). In cases of acute tears, RICE is especially important with regard to pain reduction and swelling and cryotherapy is also recommended for the first 3 days to induce vasoconstriction and reduce local blood flow (Meniscus Tear & Torn Knee Cartilage | Meniscus Injury, 2005; Houglum, 2016).

In research from Sonare et al. in 2015, properly executed conservative rehabilitation programs were found to be especially useful for management of meniscal injuries in the knee joint. Pain free functional activities are achievable, but it was found that vigorous exercise may reintroduce symptoms. Precautions to prevent reoccurrence of injury must be taken. (Sonare et al., 2015.)

## 6.2 Therapeutic Exercise

In research from Skou and Thorlund in 2018, 6 young adult patients with confirmed meniscal tear by MRI who were considered eligible for meniscal surgery by an orthopaedic surgeon underwent a 12-week supervised neuromuscular and strengthening program. There were 8 neuromuscular exercises (knee bends, pelvic lift, plank, side plank, stair climbing, outer thigh and inner thigh exercises using an exercise band, slide-exercise sideways and sideway lunge) and 4 strengthening exercises (one-legged leg press, one-legged knee extension, one-legged knee flexion and kettlebell swings) and clients had two sessions a week for the 12-week program. The patients all reported higher scorings in the Knee Injury and Osteoarthritis Outcome Score (KOOS) at the end of the program and none of them wanted surgery up to 6 months after the

study. The therapeutic exercise program was shown to be feasible in treating meniscal tears in young adults. (Skou & Thorlund, 2018.)

Additional research from Stensrud et al. in 2012 looked at a 12-week exercise program in which 20 middle aged patients with degenerative meniscus tears and had a 1-year follow-up. The exercise program included 2-3 sessions a week (of which 1 was supervised by a physiotherapist and the others were performed individually in a gym) for the 12-week period. Exercises focused on balance and lower extremity stability by neuromuscular exercises and strengthening the lower extremity muscles, plyometric exercises were added after 4 weeks and progressed accordingly. At the end of the 12-week period, 16 patients showed significant improvements on the KOOS and 19 rated themselves as 'better.' At the 1-year check-up the majority noted the improvements had been maintained and none of the patients had undergone surgery. (Stensrud et al., 2012.)

### 6.3 Manual Therapy

A study by Yung et al. in 2012 noted how only therapeutic exercise is usually incorporated in conservative treatment for meniscal tears. 5 patients with MRI diagnosed meniscus tears underwent a series of manual therapy sessions focused on knee varus mobilisations. Positive results were seen on the 1-month and 6-month check-up on the Lower Extremity Functional Scale (LEFS) and manual therapy compared well with functional exercise therapy. (Yung et al., 2012.)

The Mulligan concept of mobilisations with movement (MWM) was first developed in 1983 by New Zealand born Brian Mulligan and has been taught internationally since 1984 (Mulligan Concept - Manual Therapy, 2022). It involves the clinician applying passive joint mobilisations while the patient performs the previously provocative motion. If successful the MWM will cause immediate partial or complete reduction in pain with long lasting results. (Hing et al., 2019.)

The Mulligan Concept 'Squeeze' technique is an additional concept that when combined with MWMs can be used to treat limitations in range of motion and localised

joint line pain, both of which are common symptoms found when a meniscal tear is present (Mulligan, 2010). The technique is applied by having the clinician apply direct manual pressure along the area of maximal joint line tension and asking the patient to move into the known limited or painful range of motion. This may be uncomfortable to the patient but if successful, positive results should be seen with increases in range of motion and decreases in joint line pain. (Hing et al., 2019.)

Recent research has been done where 40 participants, who had been diagnosed with a meniscal tear were split into two equal groups, one acting as a control and one as the experimental group. Both groups received conventional therapy with the experimental group also receiving treatments of MWMs Squeeze technique. After 6 weeks both groups showed improvements in the given outcome measures, but the results of the experimental group showed a much more significant improvement in each of the parameters. (Kasturi et al., 2020.)

Hudson did a case series analysis et al. in 2016 featured 5 athletic participants who competed at either high school or collegiate level who presented with clinical symptoms of meniscal tears. They all received MWMs ‘Squeeze’ technique and were all treated until discharge (averaging 14 days with each participant receiving at least 6 treatments). 4 of the 5 participants experienced immediate improvements in symptoms after the first treatment and all reported significant improvements across all outcome measures used in the analysis by time of discharge. (Hudson et al., 2016.)

## 6.4 Modalities

Passive treatments such as modalities have been used in knee meniscus treatment. Electrical stimulation has been used for the pain management and ultrasound to improve circulation around the knee joint, however, they have not been proven to have a major beneficial effect on knee meniscus tears. (Physical Therapy for a Knee Meniscus Tear, 2022.)

# 7 AIM AND OBJECTIVES

The aim of this thesis is to increase the evidence-based knowledge concerning the topic of the differences in effectiveness in both conservative and surgical treatments of meniscal tears in the knee joint. The objective of this thesis is to investigate and compare the results of these two different approaches by means of a systematised literature review. The systematised literature review will revolve around the following question: How effective is conservative treatment when compared to surgical treatment in cases of meniscus tears in the knee.

# 8 THE THESIS PROCESS

## 8.1 Implementation of Thesis Process

From working several years in multiple theatre departments of hospitals, the author has always had a keen interest in surgery and rehabilitation. It led to a mindset developing which considered surgery a necessity for a condition to be fixed. However, this mindset was challenged in early clinical practices as the idea of conservative therapy to treat conditions routinely operated on was introduced. Further research into related topics came from this before the author settled on meniscal tears as the condition to be investigated and wanted to compare the effectiveness of conservative treatment and surgical treatment. A detailed timeline of the thesis process can be seen in Table 1 below.

Table 1. Schedule of thesis process

| | |
|---|---|
| December 2nd 2022 | Present thesis plan to group |
| Winter 2021 | Source literature and begin authoring the thesis |

| | |
|---|---|
| Spring 2022 | Continue searching for literature and authoring the thesis |
| Summer 2022 | Finish the theory section |
| October - November 2022 | Conduct the systematised review |
| November 2022 | Finish authoring the thesis |
| November 22nd 2022 | Present the final product |

## 8.2 Systematised Literature Review

This thesis will follow the format of a systematised literature review. A systematised literature review does not meet the rigorous criteria of a systematic review and are typically conducted by postgraduate students (Sataloff et al., 2021). The systematised review tends to involve a single author who may research and retrieve results from just one database (Grant & Booth, 2009). While a systematic review must adhere to a strict 5 step model, the systematised review has more freedom with these guidelines (Khan et al., 2003).

## 8.3 PICO Framework

In producing the research question the PICO model was used. The PICO model is the most widely used model for the formation of clinical questions. It focuses on having the author clearly define the problem, interventions and outcome related to specific care provided to a patient and also facilitates the search process by prompting the author to select the language and key terms to be used in the search. (Eriksen & Frandsen, 2018.)

P = Population of interest. Patient or the problem to be addressed
I = Intervention. Exposure to be considered, treatments/ tests
C = Control. The control/ comparison intervention treatment/placebo/standard of care
O = Outcome. The outcome of interest
(Aslam & Emmanuel, 2010)

The PICO model can then be used to formulate the research question by filling in the framework related to your chosen research topic.

P → MENISCUS TEAR

I → CONSERVATIVE TREATMENT

C → SURGICAL TREATMENT

O → PAIN FREE AND WELL FUNCTIONING KNEE

## 8.4 Research Question

The research question should summarise the main objective of the review. It will increase efficiency by prioritising identifying and obtaining relevant literature and keep the content focused on the relevant topic to be discussed. (Jahan et al., 2016.)

This systematised literature review will address the question: How effective is conservative treatment when compared to surgical treatment in cases of meniscus tears in the knee. The approach to be taken in this review will analyse evidence-based research to interpret the findings of the research question.

## 8.5 Inclusion and Exclusion Criteria

Eligibility criteria will be applied in the literature search to ensure all relevant studies are included and all studies which are not found to be consistent with the research question can be excluded (Meline, 2006). The specific inclusion and exclusion criteria used in this study are demonstrated in table 1.

Table 2. Inclusion and Exclusion Criteria

| **INCLUSION** | **EXCLUSION** |
|---|---|
| 01.01.2013 or newer | Articles older than 01.01.2013 |
| Articles published in English | Published in other languages |
| Full text accessible for free | Full text not accessible for free |

| | |
|---|---|
| Humans as test subjects | Another lifeform as test subjects |
| Meniscus or meniscal tear | Other pathology such as ACL tear |
| PEDro score 6/10 or higher | PEDro score 5/10 or lower |
| Clinical trials | Other forms of study |

# 9 RESULTS

## 9.1 Search Strategy

The search strategy can be built by taking key words and synonyms from the PICO model and using them to retrieve relevant studies such as in the case of this study, knee meniscus AND conservative AND surgical AND versus. Using variations of these terms and incorporating MeSH terms will allow you to initially retrieve a vast number of studies relevant to your research question.

PubMed was chosen to be the database used in this systematised literature review. For this type of review at bachelor's thesis level for a single author it is permitted to use one database. The search was conducted using the search phrase ("meniscal tear" OR "meniscus tear" OR "menisci tibial" OR "tibial meniscus") AND (surgery OR surgical OR operative) AND (conservative OR therapy OR rehabilitation) AND (versus OR compared OR comparison). The database search was undertaken on 26.10.2022.

## 9.2 Study Selection

The initial search on PubMed yielded 2,322 results. Filtering it so only studies which the full text was accessible for free reduced the search results to 546 and this was further reduced to 404 when only studies published more recently than 01.01.2013

were taken. Through exclusion of duplicates, studies which have not been undertaken yet and studies which are not consistent with the research question, 5 studies were remaining.

The Physiotherapy Evidence Database (PEDro) was used to evaluate the methodological quality of the included studies. Its function is to allow researchers to quickly assess the reliability and results of research for use in clinical practice by scoring them on a scale of 0 – 10 (Areolino Pena Matos & Maycon Sousa Pegorari, 2020). On the PEDro scale, scores of 6 – 8 are considered 'good' and scores of 9 – 10 are considered 'excellent,' below this they are considered either 'poor' or 'fair' (Cashin & McAuley, 2020). Of the 5 studies remaining, only 3 scored 6/10 or higher in the PEDro scale, with one scoring 5/10 and the other being inaccessible.

Table 3. The Prisma Flow Diagram (Page et al., 2021).

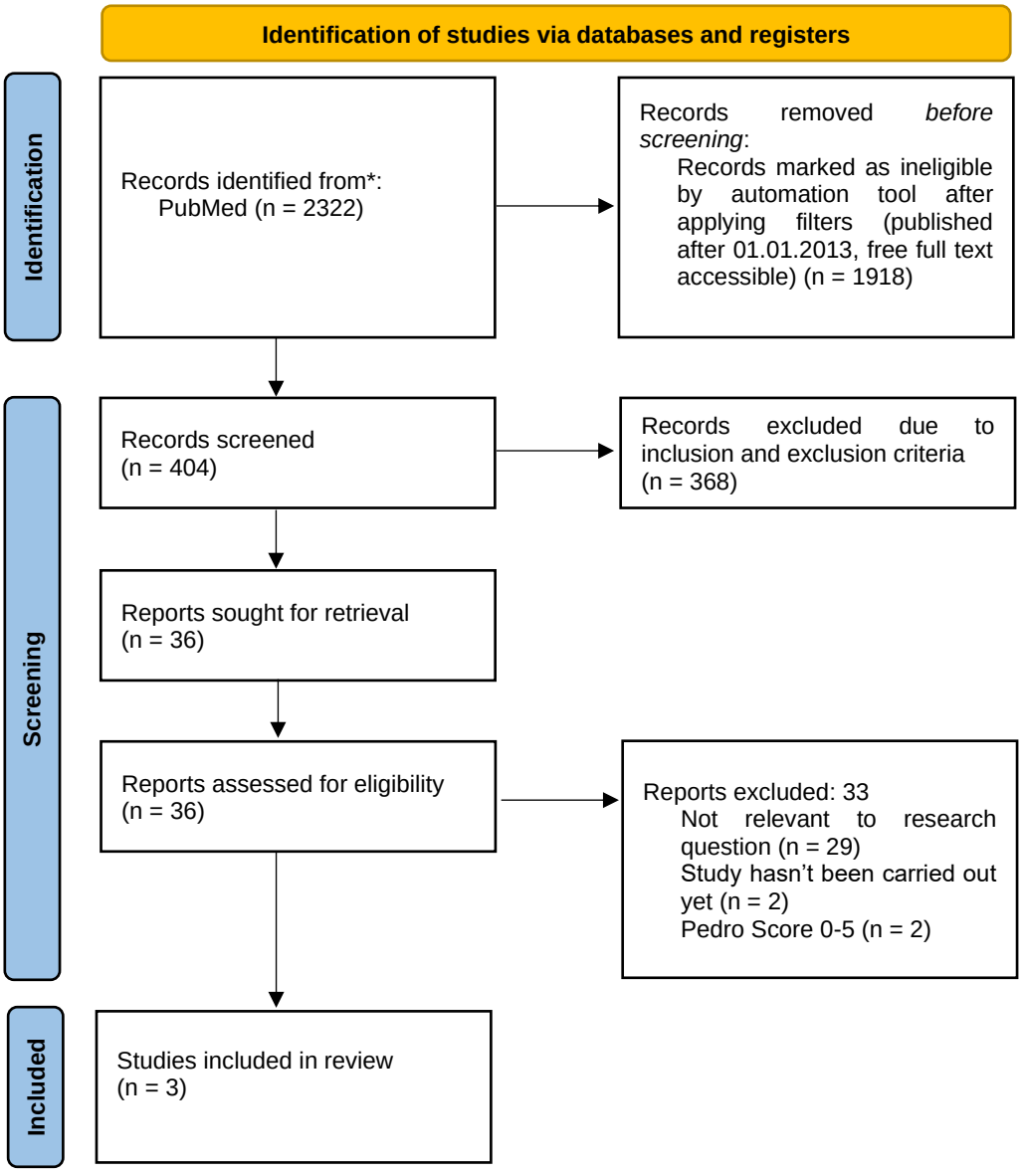


Table 4. PEDro Scale for methodological quality assessment

| **Author** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **Score** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Kise et al., 2016 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 8/10 |
| van de Graaf et al., 2018 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 7/10 |
| van de Graaf et al., 2020 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 6/10 |

Table 5. Chosen Study Summary

| **Authors and Publication Year** | **Title of Paper** | **Type of Study** | **Results and Conclusion** |
|---|---|---|---|
| Kise et al., 2016 | Exercise therapy versus arthroscopic partial meniscectomy for degenerative meniscal tear in middle aged patients: randomised controlled trial with two year follow-up | Randomised Control Trial | No clinically relevant difference was seen between the 12 week supervised exercise therapy group and the arthroscopic partial meniscectomy (APM) group at the 2 years follow up. The knee injury and osteoarthritis outcome score (KOOS4) was used. Short term improved thigh muscle |

| | | | |
|---|---|---|---|
| | | | strength was seen in the exercise group. The study concludes that in cases of degenerative tears with no definitive evidence of osteoarthritis, supervised exercise therapy should be considered a treatment option. |
| van de Graaf et al., 2018 | Effect of Early Surgery vs Physical Therapy on Knee Function Among Patients With Nonobstructive Meniscal Tears: The ESCAPE Randomized Clinical Trial | Randomised Clinical Trial | In this random trial at the 24 month follow up period a slightly greater improvement was seen in the arthroscopic partial meniscectomy (APM) group compared to those who received physiotherapy (PT). This improvement was so slight it fell within the P value to rank PT as noninferior to APM. More adverse effects such as follow up surgery and additional outpatient visits for knee pain came in the APM group. PT may be considered an alternative surgery for non-obstructive meniscal tears. |
| van de Graaf et al., | How do the costs of physical therapy and | Clinical Trial | After random allocation between physiotherapy |

| | | | |
|---|---|---|---|
| 2019 | arthroscopic partial meniscectomy compare? A trial-based economic evaluation of two treatments in patients with meniscal tears alongside the ESCAPE study | | (PT) and arthroscopic partial meniscectomy (APM), PT was associated with significantly lower costs after 24 months. PT also shown to be noninferior for quality adjusted life years (QALYs). Findings suggest de-implementation of APM for patients with non-obstructive meniscal tears |

### 9.3 Effectiveness of conservative treatment when compared to surgical treatment in cases of meniscus tears in the knee

Now that appropriate studies have been identified they can be linked back to the research question, and it can be addressed. The chosen studies all bring different comparative outcome measures which helps paint a better picture of the effectiveness of conservative when compared to surgical treatment.

Kise et al. found in 2016 at the 2 years follow up of their randomised control trial that the difference in knee injury and osteoarthritis outcome score (KOOS4) between the group which received 12 weeks of supervised exercise therapy and the group which received arthroscopic partial meniscectomy (APM) was negligible. At the three month mark there was no difference in score between the two groups, however the APM group reaches its plateau at 12 months and then is eventually overtaken by the exercise therapy group at the 24 month mark. At the 2 year mark, the exercise group reported significantly fewer knee symptoms such as swelling, mechanical problems and reduced range of motion. (Kise et al., 2016.)

van de Graaf et al. did a study in 2018 on patients aged between 45 – 70 with non-obstructive meniscal tears. Half of the participants received APM, and half received 16 sessions of exercise therapy over 8 weeks focused on coordination and closed kinetic chain strength exercises. At the 24 month follow up there was a greater improvement in the group which received APM, and 29% of the PT group had APM during these 24 months. However, the difference between the groups was minimal and was not enough of a margin to deduce PT was inferior to APM. There was also a greater number of adverse effects in the APM group, such as repeat surgeries and visits to the outpatient ward for knee pain. (van de Graaf et al., 2018.)

In further research from van de Graaf et al. in 2019 the cost effectiveness of PT compared to APM in patients with non-obstructive meniscal tears was assessed. The knee function was assessed using International Knee Documentation Committee (IKDC) and quality- adjusted life years (QALY). PT had a high probability of being non inferior to APM and was associated with significantly lower costs after 24 months when compared to APM. This result further supports the de-implementation of APM for patients with non-obstructive meniscal tears. (van de Graaf et al., 2019.)

# 10 CONCLUSION

There is some very encouraging evidence to suggest that conservative treatment may be as effective as surgical treatment for certain types of meniscal tears. In the case of non-obstructive meniscal tears, where there is no mechanical blockage and therefore no locking of the knee or instability, the conservative approach seemed more favourable on numerous factors in the long term. Knee function and quality of adjusted life years were ranked equally in the long term results of both surgical and conservative treatments, while conservative treatment was seen to be predictably more cost effective.

The short term results lent slightly more in the favour of surgical intervention but there was also a higher number of complications and adverse effects when taking the surgical route. More high quality studies are needed on greater population sizes and different demographics, such as athletes and young adults, before one can conclude that conservative can be considered as effective as surgical treatment for all meniscal tears. However, in the case of diagnosed non-obstructive tears, there should always be good consideration given to conservative treatment before surgery is proposed.

# 11 DISCUSSION

Initially, the author set out in this thesis process to understand and investigate whether something which has traditionally been done a certain way for years, could actually be managed by different methods which would be more favourable for the patient. From years of working in the theatre department of a hospital, the author has always been fascinated by surgery. A condition that has been lifestyle altering or causing pain, can be resolved in less than an hour in some cases. It is easy to fall into the headspace to think surgery is the be all and end for various conditions and nothing else will work to the same extent.

During the early physiotherapy studies, the author started to see things differently and started to question whether other processes could have the same or better effects to surgery for certain conditions and to what extent could the human body recover through conservative measures rather than opting for surgery. During one of the first clinical placements the author's thought process was challenged by the physiotherapy team as they vented frustrations at the quantity of hip arthroscopy surgeries being done on objectively healthy hip joints. A further insight into this was sought out, to see whether there was a valid basis for this apparent over prescription of surgery.

The author thought about several different topics before deciding on meniscal tears. Labral tears in the hip joint were first considered and whether they could be conservatively treated, then looking at conservative treatment for ruptures of the

anterior cruciate ligament, before deciding knee meniscal tears was the direction to go in. The author  believed this would be an understudied topic when compared to ACLs and wanted to explore the effectiveness of conservative treatment. Hope was found, at the beginning of the thesis process, that some supported evidence would exist that in some cases conservative treatment can be used to treat meniscal tears, but it was not yet known whether this hope was realistic or just a false hope.

In the theory part of the research the author was particularly impressed with the Mulligan Concept MWMs and 'Squeeze' technique as part of the conservative treatment. There was not a great amount of information on this topic online and the studies concerning it were either case studies or clinical trials with a sparse number of participants. The results however were very promising, with mentions of immediate pain relief and improvements in joint range of motion over the course of the treatment. This warrants further studies to be undertaken, with a larger sample size and a further comparative measures.

The search yielded a small number of high quality results. Some of the final ones excluded were protocols for future studies looking at this topic, which is promising for the further research needed. There was also studies which scored too low on the PEDro scale to be included but still produced some interesting results, concluding again that conservative treatment cannot be seen as inferior to conservative regarding meniscal tears and also a there can be a high prevalence of  total knee replacement (TKR) following those who received APM after 5 years compared to those who received conservative treatment (Katz et al., 2019).

In the future, when more research is available, a more detailed study, beyond the scope of bachelor's thesis could be considered. A systematic literature review of multiple databases could compile a greater volume of data and evidence to support the claim that conservative treatment can be as effective as surgical treatment in the case of meniscal tears. The results seen in this thesis can be utilised in the teaching of this area, as reliable evidence has been found to support the use of conservative measures when treating some types of meniscal tears, this should be focused on in teaching programs as the incidence of meniscal injuries is on the rise in recent years.

As all of the literature reviewed in this thesis deals with degenerative or non-obstructive tears, further studies should be undertaken on different demographics. As it is a common injury in athletes there should be comparative studies into conservative treatment with regard to acute tears, adding in time taken to return to play as one of the outcome measures.

As this was the authors first time authoring a thesis, a great deal of care was taken to ensure its reliability in the scientific field. The strengths of the thesis are that the author took on a systematised review approach which has less strict guidelines than the systematic review, however the author still followed all the guidelines as closely as possible to ensure a high quality work was produced. Several times when guidance was needed the supervising teacher and other peers were called on to allow the author to step back and see the thesis as a whole, to give insight into what an external reader will see it as.

A possible weakness of the thesis is as it is the first done by the author there may be structural or content issues which those of more experience would be able to notice at a glance. The search strategy was extremely strict, and some studies may have been missed due to not expanding the search words more. I believe having done a full systematic review with an additional author, additional databases and a superior search strategy would improve the quality of the results.

Ultimately, this thesis addresses the research question at hand and gives evidence that in some cases conservative treatment is not inferior to surgical treatment in knee meniscal tears. However, further research is needed to define the full effectivity of conservative treatment.

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