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Medial Meniscus Posterior Root Tear: A Comprehensive Literature Review

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Abstract
Introduction: medial meniscus posterior root tear (MMPRT) is an injury that leads to loss of the meniscus's biomechanical function and a sharp increase in cartilage load, which promotes the rapid development of knee osteoarthritis. It occurs mainly in older people, women, patients with obesity, low physical activity, and limb axis disorders, and in Asian populations it is additionally associated with habits requiring deep knee flexion. Due to nonspecific symptoms, the diagnosis of MMPRT is sometimes delayed, and magnetic resonance imaging remains the gold standard for diagnosis. Current treatment focuses on anatomical root repair techniques, which better protect the joint from degeneration than meniscectomy or conservative management. This paper summarizes the current knowledge on the pathophysiology, diagnosis, and treatment of MMPRT.
Purpose
Medial meniscus posterior root tears (MMPRTs) are increasingly common due to aging populations, sedentary lifestyles, and obesity. These injuries disrupt knee biomechanics, affecting joint stability and load distribution. This

study reviews anatomy, biomechanics, and classification of MMPRTs, emphasizing early diagnosis and treatment to prevent joint degeneration.

Materials and Methods

A review of current literature was conducted, focusing on diagnostic tools such as physical exams and imaging, with MRI identified as the gold standard. Injury classifications (e.g., LaPrade system) and criteria for conservative versus surgical management are discussed. Surgical techniques, including suture anchor repair and transtibial pull-out methods, were evaluated. Literature available in the PubMed and Google Scholar databases was searched using keywords.

Results

MRI remains the most accurate diagnostic tool, though its precision depends on imaging protocols. Surgical repair, especially anatomical techniques, yields better biomechanical and clinical outcomes than conservative approaches. Techniques like suture anchors and Mason-Allen stitches enhance stability and tissue regeneration. Non-operative methods may relieve symptoms but fail to restore anatomical function and can lead to progressive degeneration.

Keywords: medial meniscus posterior root tear, medial meniscus tear, knee menisci, medial meniscus diagnostics, medial meniscus treatment

1. Introduction

Damage to the posterior root of the medial meniscus is a common injury in society. Where it is particularly often noticeable in Asian society, due to the lifestyle these people lead - it is worth noting the style of sitting with frequent crossing of legs or sitting on the floor in the seiza position[1–3]. The incidence of this injury is also higher in people with a higher BMI, older age, low physical activity, sedentary lifestyle, female gender, and general knee varus[1,4–7]. Damage to the posterior root of the medial meniscus may occur in middle-aged people who are accompanied by a painful crackling sound in the posteromedial area of the knee when performing slight knee flexions, such as walking or climbing stairs[4,8]. The first person to describe damage to the medial meniscus was M J Pagnani et al. in 1991, describing a case of medial meniscus extrusion, where the meniscus subluxated from the tibiofemoral joint as a result of posterior horn dislocation with concomitant damage to the medial and posterior cruciate ligaments[9].

1.1 Anatomy

The medial meniscus posterior root (MMPR) attaches the meniscus to the tibia. It consists of fibres running parallel to the long axis of the meniscus, made up mainly of collagen, thus increasing tensile strength. It attaches on the posterior inferior slope in the posterior intercondylar field, more specifically posteriorly to the medial apex of the tibial process and laterally to the edge of the articular cartilage of the posterior tibial plateau and anteriorly to the insertion site of the posterior cruciate ligament[10]. This attachment is located: 9.6 mm posteriorly and 0.7 mm laterally from the medial tibial epicondyle (MTE). The average surface area of the attachment is approximately 30.4mm2[10,11]. The transition of the fibrocartilage structure of the meniscus to the ligamentous structure facilitates the transfer of loads from the meniscus to the bone[11]. The MMPR stabilises the meniscus between the femoral condyle and the tibial acetabulum and plays an important role in pressure distribution and uniform pressure absorption[10,11]. The MMPR also contains posterior fibular extensions - shiny white fibres that increase the attachment area of the meniscus and are used as anatomical landmarks during surgical procedures involving the MMPR or the posterior cruciate ligament[11].[FIGURE A]

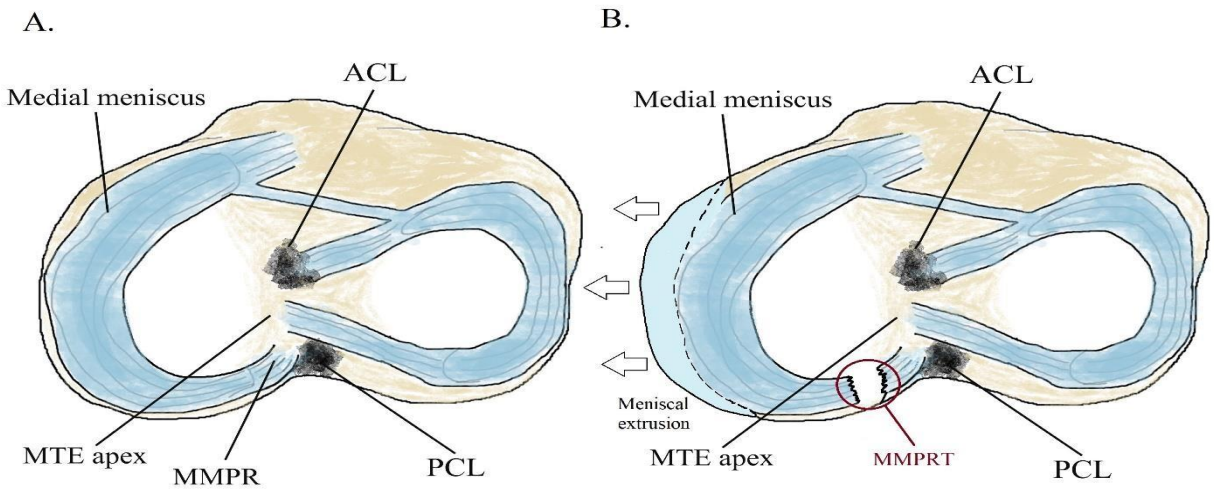

Figure 1.

A. Figure showing the normal posterior root of the medial meniscus along with other surrounding structures.

B. Figure showing a posterior root tear of the medial meniscus, which causes loss of rim tension and results in meniscus extrusion. ACL: anterior cruciate ligament; MTE: medial tibial eminence; MMPR: medial meniscus posterior root; PCL: posterior cruciate ligament; MMPRT : medial meniscus posterior root tear.

1.2 Biomechanics

The MMPR has an important role in transferring and distributing the load applied to the meniscus, in this way protecting the adjacent articular cartilage. The rim tension generated by the collagen fibres that make up the meniscus and its root counteracts the compressive forces acting on the knee joint, while keeping the meniscus between the femur and tibia and allowing the joint to properly transmit loads[2,10,11]. MMPRT pushes the meniscus between the two bones, causing a loss of rim tension and thus leading to a loss of the meniscus' ability to transmit loads. This condition increases the contact pressure between the femur and tibia by 25 %, which is equivalent to the contact pressure after a total medial menisectomy, and reduces the area in the medial compartment of the knee[2,10–12]. On the other hand, MMPRT repair restores the mechanics of the joint to a state similar to the intact knee under zero time conditions. However, non-anatomical repair may not restore the native biomechanics of the knee. In addition to load profiles, MMPRTs have a direct effect on knee stability, causing rotation and translation of the joint[11].

2. Causes and types of damage to the posterior root of the medial meniscus

2.1 Causes and patterns of damage

MMPRT can be caused by degenerative changes or acute, sudden trauma to the lower limb. Degenerative MMPRT most often occurs during normal daily activities without

accompanying acute trauma to the knee[4]. Injuries contributing to radial tears are often caused by degenerative changes of the meniscus, which occur in the fourth and fifth decades of life[13].

Degenerative MMPR makes the meniscus predisposed to tear even with trivial trauma[2]. Degenerative MMPRTs are relatively more common than traumatic MMPRTs and are more predisposed to tears than root tears in other locations[4]. Posterior root tears are more common in the medial meniscus than in the lateral meniscus because the lateral meniscus moves posteriorly in flexion by an average of 19 mm and the medial meniscus by only 4 mm, making the MMPR more predisposed to impact between the femur and tibial plateau, leading to an increased risk of meniscus injury[2]. Medial meniscus root injuries occur with lowenergy injuries and are characterised by greater extrusion compared to lateral meniscus root injuries, which typically occur with higher-energy injuries[14].

Possible risk factors for degenerative MMRT(Medial meniscus root tear) include older age, female gender, increased body mass index (BMI), increased patellar alignment of the lower limb and reduced physical activity levels[4]. High BMI is significantly associated with MMPRT at younger ages[15]. Traumatic MMPRT often coexists with ligament injuries of the knee. Anterior cruciate ligament injuries may accompany MMRT.

The incidence of traumatic MMPRT associated with knee ligament injuries ranges from 3% to 14%[4,11]. High knee flexion is thought to cause repetitive damage to the posterior root of the medial meniscus (MM), resulting in subsequent degenerative changes and MMPRT. Based on studies of MMPR injury patterns, it was found that high knee flexion is not the most common cause of sudden onset MMPRT. It was shown that the most common pattern of MMRT was descending knee motion associated with walking up stairs and descending slopes with a low knee flexion angle $< 30^{\circ}$. Descending knee motion was the most common cause of acute MMPRT (38%), followed by injury patterns associated with walking (18%) and squatting associated with high knee flexion (13%). Other injury patterns such as standing up, falling, twisting, light exercise and minor car accidents accounted for less than 10%[4].

2.2 Definition and classification

MMPRT is an avulsion or tear, usually radial, located 10 mm from the tibial attachment of the medial meniscus posterior root [Figure B]. The types of MMRT injuries can be classified according to the system of LaPrade et al. as follows: type 1: partial, stable root tear; type 2: complete radial tear within 9 mm of the bony attachment of the meniscus root; type 3: bucket-handle tears with complete meniscus root detachment; type 4: complex/angular tears with complete root detachment; type 5: bony avulsion tear of the meniscus root[7,11,16–19]. [TABLE 1]

The LaPrade classification system for meniscus root injuries characterises meniscus root injuries based on morphology. The system was originally developed based on arthroscopy. This system helps to distinguish MMPRT from other types of meniscus injury and with it the type of treatment can be determined. Furthermore, the chronicity of MMPRT can be estimated with this system. Types 1, 2 and 4 are associated with acute or chronic tears, while types 3 and 5 are usually found in acute traumatic tears. Of these five types of MMPRT, type 2 is the most common[11,18].

The increased incidence of root injuries, which are increasingly being diagnosed, has resulted in the detection of many new morphological patterns of meniscus root injuries, so it was decided to extend the LaPrade classification to include types 6,7 and 8[20,21]. [TABLE 1]

A certain disadvantage of the LaPrade classification is that it covers both traumatic and degenerative MMPRT and does not show a relationship between articular cartilage condition and type, limiting its use in the clinical setting.

Therefore, an arthroscopic classification system for degenerative MMPRTs based on the tear gap was presented, where the LaPrade classification is based on the distance of the tear from the root. The new classification showed that a higher tear type correlates with greater extrusion of the meniscus, increased cartilage wear and greater severity of arthritis[22].

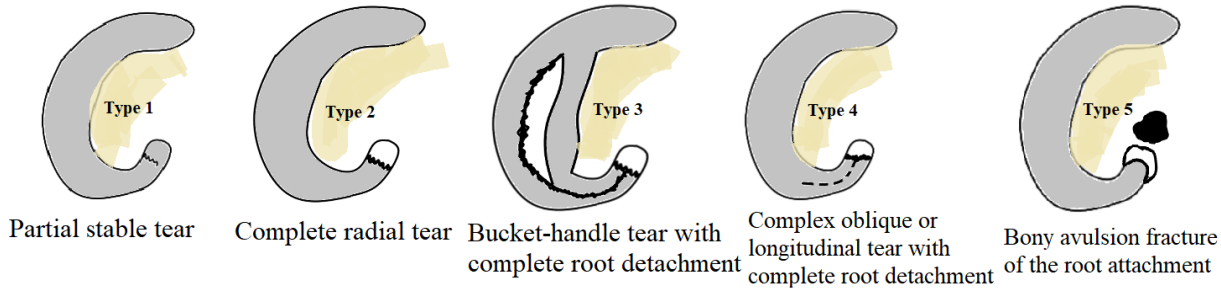

Figure 2. Classification of meniscal root tears according to LaPrade

TABLE 1.

Classification of anterior and posterior medial and lateral meniscus root tears based on tear morphology (given with prevalance), extended to include types 6,7 and 8

Type	Subtype	Description
1(7%)		Partial stable tear
2(67.6%)		Complete radial tear within 9 mm from attachment
	2a(38%)	Complete radial tear 0 to <3 mm from attachment
	2b(16.9%)	Complete radial tear 3 to <6 mm from attachment
	2c(12.7%)	Complete radial tear 6 to ≤9 mm from attachment
3(5.6%)		Bucket-handle tear with complete root detachment
4(9.9%)		Complex oblique or longitudinal tear with complete root detachment
5(9.9%)		Bony avulsion fracture of the root attachment
6		Complete root tear with horizontal cleavage tear of the meniscus with or without extension into the root
7		Complete root tear with meniscocapsular separation
8		Complete root tear with substance loss of meniscus extending more than 1 cm from root

3. Diagnostics

MMPRT usually occurs with daily activities such as crouching, standing up from a chair, climbing or descending stairs, and the most common symptoms are pain in the back of the knee and tenderness of the joint line, especially with deep squatting, which are non-specific symptoms[11,23,24].

Another common symptom is painful crackling in response to a trivial injury, which is a very good indicator of MMPRT and has a very high predictive value of 96.5%[2,11,24,25].

It has been shown that approximately 70% of patients with meniscus root injuries could recall a minor traumatic event, such as squatting, and the remainder could not recall any specific event leading up to the injury, and 85-91% of patients, thought to remember the onset at which symptoms occurred[11,18,23].

3.1 Physical examination

In the doctor's office, the examiner may perform tests to detect or exclude meniscal damage for further diagnosis. Tests that can be used include McMurray's test, Apley's test (also known as the distraction-compression test), and Akmese's sign[6,26,27]. Where the first two tests only determine the location in terms of the lateral or medial meniscus. The Akmese sign is the most sensitive to damage to the posterior root[6].

The Akmese sign is a new test used in clinical examinations. Involves placing the patient in a supine position with the limb being tested in a figure 4 position, allowing the knee to assume a slight varus position, causing release of the medial collateral ligament and medial capsule. In this examination, the patient is palpated (preserving external rotation and hip flexion) of the medial joint line for pain as knee flexion decreases to 10° to 20° near extension. Next, the knee is brought into hyperextension - 110°-130°, and the medial joint line is examined again. A positive sign is when patients have tenderness in the angles near extension and minimal or no tenderness in hyperflexion[6].

3.2 Imaging

MRI is the gold standard for detecting MMPRT, but studies conducted by different researchers show different opinions on this subject[6,7]. The study by Bin et al. showed an accuracy of 66.3% in detecting MMPRT and did not ensure the specificity of the nature of the damage. They found it too difficult to assess the posterior root and its damage using MRI[28]. In turn, studies by Lee et al. showed sensitivity, specificity, and accuracy of 86-90%, 90-94% and 94%. Subsequent researchers also support the research of Lee et al., where their research also confirms these results[2].

MMPRT signs on MRI include: (1) a vertical high signal representing a vertical linear tear of the meniscus root on the frontal plane (shear or cleft sign), (2) a vertical high signal indicating a break in the posterior region of the meniscus root on the axial plane and (3) a ‘ghost sign’ which is the inability to identify the MMPR on the sagittal plane or an increased signal replacing the normally dark signal of the meniscus but the meniscus immediately appears on adjacent images[11,23,24,29,30].

Extrusion of the medial meniscus in the frontal plane may be important in predicting MMPRT, in particular meniscus extrusion greater than 3mm may correlate closely with MMPRT[31–34]. Due to the highest specificity and sensitivity values, T2-weighted sequences are considered the best for MMRT imaging[35]. New MRI signs of MMPRT such as parameniscal cysts, subchondral swelling of the marrow, ‘giraffe neck sign’, ‘spreading root sign’, or posterior shiny corner lesions have been described to improve diagnosis[36–38].

Plain load radiographs, including anteroposterior and lateral radiographs, are recommended during the initial diagnosis of MMRT. In particular, a loaded knee X-ray in the posterior-anterior (PA) projection in 45° flexion (Rosenberg projection) provides a good assessment of knee joint space narrowing[2,39,40]. MMPRT causes meniscus extrusion and there is narrowing of the joint space in the knee, acceleration of the progression of arthritis and knee talus[29,41]. Additionally, CBCT can be useful to analyse joint space narrowing and meniscus extrusion[42].

MMPRT causing pathological loading in the knee, in addition to meniscus extrusion, can result in tibiofemoral subluxation[40]. A flexed knee, more so than an upright knee, results in an increase in tibiofemoral contact area and contact pressure, so radiographs obtained during loading with the knee flexed are more useful for assessing MMPRT than those taken with the knee straight[43]. MMPRT decreases the medial articular space of the knee, which is most likely due to medial meniscus subluxation and osteoarthritis[39,40]. Additionally, MMPRT increases the distance between the medial tibial process and the lateral edge of the medial femoral condyle and decreases the medial articular space on loading posterior radiographs of the knee[40].

It has been shown that unloaded X-ray tunnel view can be useful for initial diagnosis and for assessing MMPRT progression in the short term[40,44]. Ultrasound can be useful to accelerate the diagnosis of MMPRT and, as a result, action can be taken more quickly to prevent osteoarthritis progression[45]. Dynamic ultrasound evaluation of medial meniscus extrusion in patients with knee osteoarthritis has shown high sensitivity and specificity in the diagnosis of MMPRT[46].

Ultrasound studies assessing the size and degree of extrusion of the medial meniscus, can be used to determine the incidence of MMPRT. The use of ultrasound can assist in the diagnosis of MMPRT in the outpatient setting[47].

4. Indications and types of treatment and complications

There is no gold standard treatment. The doctor decides which one to choose for the patient, and there are many choices. Conservative and surgical treatment can be used. However, there are trends such as the use of suture anchors and pullout sutures. It will be useful in the future to rank these possibilities and establish standardization for the safety of the patient's health[2].

4.1 Non-Operative Treatment

Due to very good postoperative results in patients with MMRT, non-surgical treatment is rarely used. To name just a few specific situations in which this type of treatment is used, Moon et al. list here: (1) older patients, (2) those with significant comorbidities, (3) those with advanced knee osteoarthritis (Kellgren- Lawrence[48] grade ≥ 3), and (4) those unwilling to comply with a strict postoperative rehabilitation protocol[11]. In their work, Santiago Pache et

al. mention the most common classification of elderly patients with diffuse, highgrade osteoarthritis (Outerbridge 3-4)[19].

The purpose of this treatment is to improve the quality of life of patients. The following are recommended: (1) intra-articular injections, (2) knee braces, (3) painkillers (oral or topical), and lifestyle modification with increased physical activity[11,19,49].

4.2 Surgical treatment

4.2.1 Indications for Surgery

There are no clear indications for surgical repair of MMPRT`s, they are constantly modified on the basis of numerous scientific works. However, researchers present several of them that, according to current medical knowledge, are the best.

Patients who are qualified for such surgery must meet several conditions, such indications include: (1) age under 65, (2) being physically active, (3) no serious arthritic changes in the knee joint, (4) Classification Outerbridge less than grade 3°, (4) no high BMI, (5) Kellgren-Lawrence Scale[48] grade I or II, in some cases also III, (6) no severe lower limb varus, (7) willingness to follow a rigorous program postoperative rehabilitation[2,11]. However, point 1 regarding age may be subject to change due to the difference in the patient's calendar age in relation to the biological age, in such cases, the patient's physical activity and concomitant diseases should be taken into account here. Arthritic lesions should be evaluated by a physician using plain radiography, MRI, or arthroscopy. In the case of varus alignment of the lower limb, this point cannot be considered absolute due to the results of studies that indicate that the results of surgical treatment of patients with varus of the ilio-knee angle between 5° and 10° were not worse compared to patients with varus hip-knee angle <5[11]. Therefore, it is necessary to assess where the varus stems from, whether it is constitutional or pathological. Researchers have also found an association between the duration of preoperative symptoms and the outcome of surgical treatment[11].

4.2.2 Meniscectomy

Patients with degenerative disease in whom conservative treatment does not bring the expected results and they have persistent mechanical symptoms and pain that worsen the quality of life – partial resection of the meniscus may benefit, where a particularly good prognosis has been proven in patients with well-aligned knee joints not associated with inflammation joints. However, in these patients, degenerative changes continue to progress, so partial menisectomy has a short- term effect, which proves the superiority of the surgical method[19]. Additionally, researchers report that arthritic changes in the knee after partial meniscal resection are more severe than those after non-operative treatment and surgical repair[11,50].

4.2.3 Surgical Technique

The operator must select the surgical method to be used on the patient. Efforts should be made to restore the anatomical normality of the patient's meniscus whenever possible. This

should be done to avoid degenerative disease or further damage to the meniscus. There are two most used repair techniques: (1) suture anchor repair, (2) transtibial pull-out repair[11,51,52].

4.2.4 Suture anchor repair

This is an extremely technically demanding technique, it involves the use of one suture anchor with two sutures, using the all-inside technique. The anchor is inserted into the anatomical footprint of the meniscal root using a high posteromedial portal. The root is then reattached with two vertical sutures[11,19].

4.2.5 Transtibial pull-out repair

Repair may vary slightly depending on the damage to the meniscal root, so there are many techniques. It involves passing sutures through the root of the meniscus, removing them through tunnels drilled into the proximal part of the tibia, and then tying them to a post, button, or anterior bridge of the tibia. There are many meniscal suture configurations with different biomechanical properties[11,19].

4.2.6 A reverse suture anchor technique

Chen-yang Meng et al. developed a simpler and easier to perform, yet more effective treatment method. Thanks to the developed treatment method, the researchers described the possibility of eliminating the need for additional portals, which further translates into a reduced risk of iatrogenic injury. This method reduces the risk of failure due to the "bungee effect". Chen-yang Meng et al. also reported that a nearly 6-cm suture thread placed in the bone tunnel can move in it, which can potentially cause a "wiper effect"[53].

The investigators recommend using this method for (1) medial meniscal posterior horn tears, provided there is no significant cartilage damage (Kellgren-Lawrence[48] grade less than II). In the context of classifying posterior horn tears, the Christopher system[17] is the preferred methodology, which has been shown to be highly effective in treating (2) type 2, (3) type 3, and (4) type 5 tears. In contrast, for type 1 tears and radial type 4 tears, a more traditional approach of sutured meniscal repair is recommended, due to the distinct morphological features of these tears and their better response to surgical intervention[53].

TABLE 2.
Advantages of the reverse suture anchor technique

(1) Shorter operative time
(2) Reduced "bungee effect"
(3) Avoidance of additional incisions
(4) Early postoperative functional rehabilitation of the affected limb

4.2.7 Repair Using the Nice Knot

Revelt et al. presented a technique that demonstrates superior efficacy in medial meniscal posterior horn repair . Their innovative Nice knot allows for controlled tension adjustment during the repair procedure, which is crucial for optimizing clinical outcomes. Additionally, this knot allows for stabilization of tension in a fixed position, facilitating visualization of the repair site and precise adjustment. In situations where malposition or excessive tension occurs, the Nice knot can be easily untied, which increases surgical flexibility[54].

However, the authors also noted some limitations of this method. First, the two tunnels must be positioned in close proximity to each other in the limited root attachment space, which can be technically challenging. Second, the presence of multiple loops and suture segments can complicate suture management, which in turn can affect the efficiency of the entire procedure[54].

This method utilizes a transtibial technique with modifications in suture fixation and tensioning. Initially, the researchers use two double sutures, which are passed through the meniscal root to create a looped end and a twin-tailed end. The next step involves using a locking, tensionable, and, if necessary, reversible Nice knot, which is tied on the anterior tibial cortex above a button. This technique allows the surgeon to precisely control and adjust the tension during root repair. Tying the knot over the button on the anterior tibia ensures stable suture fixation to the meniscal root, enhancing the accuracy and effectiveness of the procedure[54].

4.2.8 Two Transtibial Tunnels with Modified Mason-Allen Stitches

Du-Han Kim and colleagues suggest that the two-tunnel technique may offer greater benefits in terms of biomechanical and biological healing compared to the single-tunnel technique. They also highlight that the continuous development of arthroscopic instruments will gradually reduce operation time, thus improving the efficiency of surgical procedures. Their research demonstrates that the Mason-Allen suture minimizes the risk of slippage and elongation of longitudinally oriented meniscal or tendon fibers, ultimately enhancing the retention strength of the repaired structures during the healing process[55].

In a comparative study using Mason-Allen (MA) sutures and simple sutures, the MA technique showed a clear advantage. It was significantly more effective in reducing postoperative root extrusion and improving the healing process. These findings suggest that using Mason-Allen sutures can significantly improve longterm clinical outcomes and provide better support for the regeneration of damaged structures[55].

4.3 Complications and prognosis

Tear or damage to the posterior root of the medial meniscus is relatively rarely detected on MRI scans, but it is important that it is well diagnosed and treated appropriately, as MMPRT

can cause a number of complications such as meniscus extrusion, secondary osteoarthritis and subchondral fractures. MMPRT is also a significant risk factor for causing osteoarthritis; in particular, meniscus extrusion, by interfering with its functionality, puts pathological stresses on the articular cartilage of the knee and leads to progressive cartilage wear and degeneration. Treatment of MMPRT is crucial to prevent accelerated progression of knee osteoarthritis in patients who did not have significant knee osteoarthritis prior to surgery[13,56–58].

Any damage to the meniscus leads to serious biomechanical consequences and results in a reduced ability of the meniscus to resist rim strains. Meniscus functions such as distribution and transmission of axial loads in the knee, force absorption, proprioception, lubrication and stabilisation of the knee joint are impaired and result in increased loading on the articular cartilage. Disruption of the collagen fibres, which resist stress, pulls out the meniscus and allows it to protrude, and this can contribute to the acceleration of osteoarthritis. MMPRT interferes with the normal biomechanics of the tibiofemoral joint and prevents proper conversion of axial loads into rim strains causing medial extrusion of the meniscus. [FIGURE B] Large radial tears and avulsions of the posterior root of the medial meniscus can increase contact forces in the joint to levels analogous to a total meniscectomy. Increased loading on the knee joint can result in a subchondral bone fracture. It most commonly affects the medial femoral condyle, followed by the medial tibial plateau and lateral femoral condyle, and least commonly both the medial femoral condyle and medial tibial plateau. Subchondral fracture is most common in the elderly, most likely due to reduced bone density in these individuals[56,58].

Non-operative treatment in some people with MMPRT may alleviate some symptoms and contribute to clinical improvement, but this is most often a shortterm improvement, after which the joint space in the knee joint narrows and the degenerative changes progress. Non-operative treatment does not restore the normal anatomy and function of the knee joint[11,19,59].

Operative repair is often recommended and even necessary in suitable patients to prevent progression of knee osteoarthritis. Based on the study, the incidence of complications after isolated repair of the posterior root of the medial meniscus was 9.7%, mainly due to the presence of progressive degeneration, while repair failure was reported in 3% of patients[57]. Progression of arthrosis was observed in 10% of patients with a mean follow-up period of 30.3 months and a mean age of 54 years after meniscus root repair[19,60].

Meniscectomy should only be used in selected cases as it has limited clinical benefit and results are generally poor. After meniscectomy, there is an increase in pressure on the residual meniscus and greater stress concentration in the tibial cartilage compared to untreated MMPRT. This leads to further development of knee osteoarthritis and degeneration of the knee joint[2,11,19]

Surgical repair using the suture anchor technique is a technically difficult method and requires specialised instruments. It carries a high risk of damaging important structures of the knee joint: cartilage, vascular and nerve damage. There is a significant risk of loosening and displacement of the anchor, which can result in the anchor slipping out before healing and subsequent failure of fixation[5,11,59].

The transtibial pull-out method, using a trans-periosteal tunnel, is less technically demanding and has a lower risk of damaging knee joint components than the anchor method. However, there are a number of problems and complications associated with this technique, such as the need to drill the tunnel, which complicates the associated ligament reconstruction, the occurrence of a bungee effect, micromotion between the meniscus-suture complex and an increased risk of suture rubbing through the tunnel before the meniscus heals, and an increased

likelihood of suture creep, which reduces the strength of the repair. Patients treated with this method have also been found to have greater meniscus extrusion, a higher incidence of incomplete healing on MRI, deterioration of the medial compartment cartilage and greater progression of cartilage degeneration [5,11,59].

5. Conclusions

MMPRT is an injury that is becoming increasingly common in our society, largely due to the modern lifestyle and the growing number of people leading sedentary or less active lives. Given these trends, it is expected that the number of MMPRT cases will steadily increase. Each patient with this condition requires an individualized approach. Contemporary medicine, including advances in diagnostics and surgical techniques, offers a wide range of treatment options. However, as new methods continue to emerge, caution must be exercised in their implementation. Many of these modern techniques still require further clinical trials, especially long-term studies, to accurately assess their effectiveness and safety. Therefore, there is a need for ongoing research on larger patient populations to better understand their real benefits and potential risks. At the same time, it is essential to remember that the patient remains at the center of the treatment process. Their opinions, needs, and preferences should be an integral part of therapeutic decision-making. The dialogue between the physician and the patient is the cornerstone of effective therapy and ensuring that the patient fully understands the proposed treatment methods is crucial. This approach not only enhances treatment outcomes but also fosters trust and cooperation, both of which are key to the success of the therapy.

Disclosure

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