

The Effectiveness of Mulligan Technique in Knee Injuries in Basketball Players. A Systematic Review

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Abstract

Background: Basketball sport requires a range of quick movements, including sprinting, cutting, spinning, and jumping. All these maneuvers do that basketball players suffer by knee injuries such as: knee meniscal injuries, patella-femoral pain syndrome, osteoarthritis and post traumatic stiffness of knee injuries. To prevent injuries, we can use Mulligan technique as an alternative treatment without side effects.

Aim: Evaluation of the effect of the Mulligan technique in improving pain, joint flexibility and functionality in knee injuries in basketball players.

Methodology: This is a systematic review conducted in the period September - October 2023. Scientific studies were searched in six

databases (PubMed, Cochrane Library, Science Direct, Web of Science, Taylor & Francis Online, PEDro, National Library of Medicine and The Lancet). These studies were conducted between 2015 and 2023 and were all in English. Randomized controlled trial studies and clinical trials were included in our study. The outcome measures that were applied to assess knee injuries were: Nprs; Kprs; Ake; Tug; Vas; Lefs; Psfs; Rome; Koos; ppt; Womack; Ols.

Results: From 209 studies found, based on the exclusion and inclusion criteria, only 8 studies were included regarding the effect of the Mulligan technique on knee injuries. In those studies, the results were achieved with statistically significant values of the effect of this

technique regarding some variables: like visual analogue scale (VAS), functional scale of the lower extremities (LEFS, PSFS), physical active disability scale (DPA), muscle strength and range of motion (ROM).

Conclusions: This literature review study was effective in evidencing the improvement through Mulligan Technique of several important elements in knee injuries such as decrease pain, increase flexibility, muscle strength and functionality.

Keywords: Mulligan Technique, knee injuries, basketball, randomized controlled trials, knee pathology

INTRODUCTION

Basketball is considered one of the most popular sports in the world (1,2) while in Albania it is the second most popular sport (3). Basketball is considered a contact sport that involves landing, sprit, repetitive rotation (4,5) with high speed. These maneuvers characteristics in basketball players make them vulnerable to musculoskeletal injuries (6), which are considered the most frequent in this group of athletes (7). The most of injuries are focused at the level of the lower part of the body in comparison with the upper part of the body (8), in which women are more prejudiced to knee injuries (9). Knee injuries are calculated at 20% compared to other levels of injuries among basketball players (7). Basketball players in 44.6% of cases suffer from tendinopathy of the *patellar tendon* (10). In most basketball players, the tendinopathy of the *patellar tendon* is asymptomatic, they have sensitivity only during palpation of the *patellar tendon* (11), in other cases the pain is localized anterior to the knee (12). These patella-femoral injuries are the most common reason for missing games (13). Another typical injury among basketball players, especially in the young basketball players, are meniscal tear. The typical mechanism of meniscal tear in basketball players is the position of the knee in flexion, rotation and compressive forces (2). Clinically, meniscal injuries are accompanied by pain, edema and often joint stiffness, reducing performance and in some cases, causing their absence in sports competitions (2). Physical examination tests for

the identification of injuries to meniscus have resulted efficient and with high accuracy of 90% and 81%: McMurray's test, Thessaly's test (14) and Apley's (14). Other type of injuries at the knee joint are (ACL) ruptures, in the USA they are continuously on the increase, because of the increase of their sports performance, continuous training and very short holiday seasons (15). In most of the cases, the basketball players that suffer from acute ACL tears result at the early start of osteoarthritis (OA) and after that they leave the sport (16). Due to the traumas and cyclic load with high intensity at the level of the knee, basketball players (17) can also be affected by Osteoarthritis (18), which includes most of basketball players (17). Osteoarthritis and injuries in basketball players depend on many factors such as age, gender and the type of activity they use (19). To prevent knee injuries in basketball players apart rehabilitative treatment based on physiology, importance should also be given to rehabilitative physical therapy and physical training (1). Starting from *patella femoral* pain syndome which requires modification of the athlete's physical activity and physiotherapeutic rehabilitation including a variety of techniques such as kinesiotaping, stretching, muscle strengthening, physical therapy but also drug treatment (20). Meanwhile in situations of meniscal tears, the best intervention for basketball players is surgical intervention (2). After that, a protocol based on the guidelines of the American College of Sports Medicine is applied in several stages of

rehabilitation (21). Exists close connection between meniscal and *ACL cruciate ligament* injuries (22). Therefore, to reduce the possibility of *ACL* injuries in the sport of basketball and not only, the injury prevention program (23) that includes exercises (Core) that focus on the trunk and lower extremities is effective (24). On the other hand, for the highest possible performance of basketball athletes, alternative physiotherapeutic, medical treatment methods without side effects should be found and use. Such is Mulligan's Technique or Concept, which finds use even during the asymptomatic state but also during the active phase with pain for basketball athletes. Through this glide mobilization combined with the active movement of the knee (25) by the athlete or patient, it is possible to benefit pain free and improvement in the range of motion and correction of mispositioning (26). Mulligan's technique has been described as an important technique for biomechanical correction and pain reduction during musculoskeletal activity (27). In this literature review our objective is to evaluate the effect of Mulligan Concept or technique and and sub-techniques in injuries at the knee level for the basketball players, also the effectiveness that this physiotherapeutic technique should have in improving some elements affected by the knee joint such as pain, flexibility of the joint, balance and functionality. Meanwhile the purpose of this study is to evaluate the impact of the Mulligan MWM technique on knee injuries in basketball players.

METHODS

1. Research strategy

An extensive literature search was performed in the period September - October 2023. This research was carried out in (8) eight electronic databases such as: PubMed, Taylor & Francis, The Lancet, PEDro, Web of Science, Cochrane Library, Science Direct, National Library of Medicine. The search was carried out using the primary filter studies of the last 10 years. The terms used for the search were: Mulligan technique, knee injuries, basketball sport, ligament injuries, tendinopathy, meniscal injuries. A more specific search was applied using the terms randomized studies in knee injuries, mulligan technique in basketball, etc.

2. Inclusion criteria

In this literature review study, the included studies were selected according to several main elements.

2.1 Type of studies

In this literature review were included, all randomized controlled trials, which were in English language.

2.2 Participants

Studies involving both men and women, treating patients with knee joint injuries such as tendinopathy, meniscus damage, knee osteoarthritis, patellofemoral pain, etc. The age of the patients included in this literature review study was from 14-62 years.

2.3 Injuries and pathologies involved

In this literature review study were included typical injuries and pathologies that appear in the

knee joint, starting with tendinopathy, meniscal injuries, knee injuries, osteoarthritis etc.

2.4 Interventions

Various forms of the Mulligan Technique for knee injuries and specific pathologies of the knee joint were included.

2.5 Outcome Measures

12 outcome measures were considered. Some of the outcomes are applied in more than one study. The outcome measures were: NPRS; KPRS; ACE; TUG; VAS; LEFS; PSFS; ROM; KOOS; PPT; WOMAC; OLS.

3. Exclusion Criteria

The exclusion criteria in this literature review study were all literature review studies, meta-analyses, case studies, quasi-experimental. Studies that are only available in the form of abstracts, information from websites, dissertations or conferences were excluded from the study.

4. Selection of studies

The selection of studies was made based on the type of randomized controlled trials study, which belonged to the last 10 years, included injuries and pathologies of the knee, as well as applying the mulligan technique with other conventional physiotherapeutic techniques. Study selection process was performed by three reviewers. Any disagreement between the reviewers should be consulted by two reviewers to reach a consensus.

5. Data Extraction

The data related to each article included general data such as title of the study, authors' name, year of publication; then data related to the study

design, outcome measures, type of treatment, duration of treatment, age of participants, treatment groups and applied techniques and final statistical results. (Table 1)

6. Risk of Bias Assessment

The risk of bias of the studies was realized using the PEDro scale 5, used for randomized controlled trials in the field of Physiotherapy which included 11 items. Studies with a score above 8 were considered high quality studies, while studies with a score between 5-7 points were considered moderate quality and studies with a score between 0-4 points were considered low quality (Table 2).

RESULTS

A total of 209 articles were first identified by the search title in several international databases such as PubMed, Taylor & Francis, The Lancet, PEDro, Web of Science, Cochrane LIBRARY, Science Direct and National Library of Medicine. Of which 100 of them were included in the screening phase, of which 40 were excluded after applying the Mulligan technique at the level of the neck. At the review stage, 52 studies were excluded (Figure 1. Prisma Diagram), and only 48 continued the review process. Based on the inclusion and exclusion criteria in the general characteristics of the studies, only 8 studies were included. The total number of patients included in this literature review study is 268 patients of which 137 are women and 131 are men, aged between 14-62 years. All the participants in this literature review study had injuries or pathologies

at the knee level, starting with patella-femoral pain, meniscal injury, osteoarthritis and joint stiffness after a fall. All the characteristic data of

the studies included in this literature review are defined in table number 1. The selected studies belong to the period from 2015 to 2023.

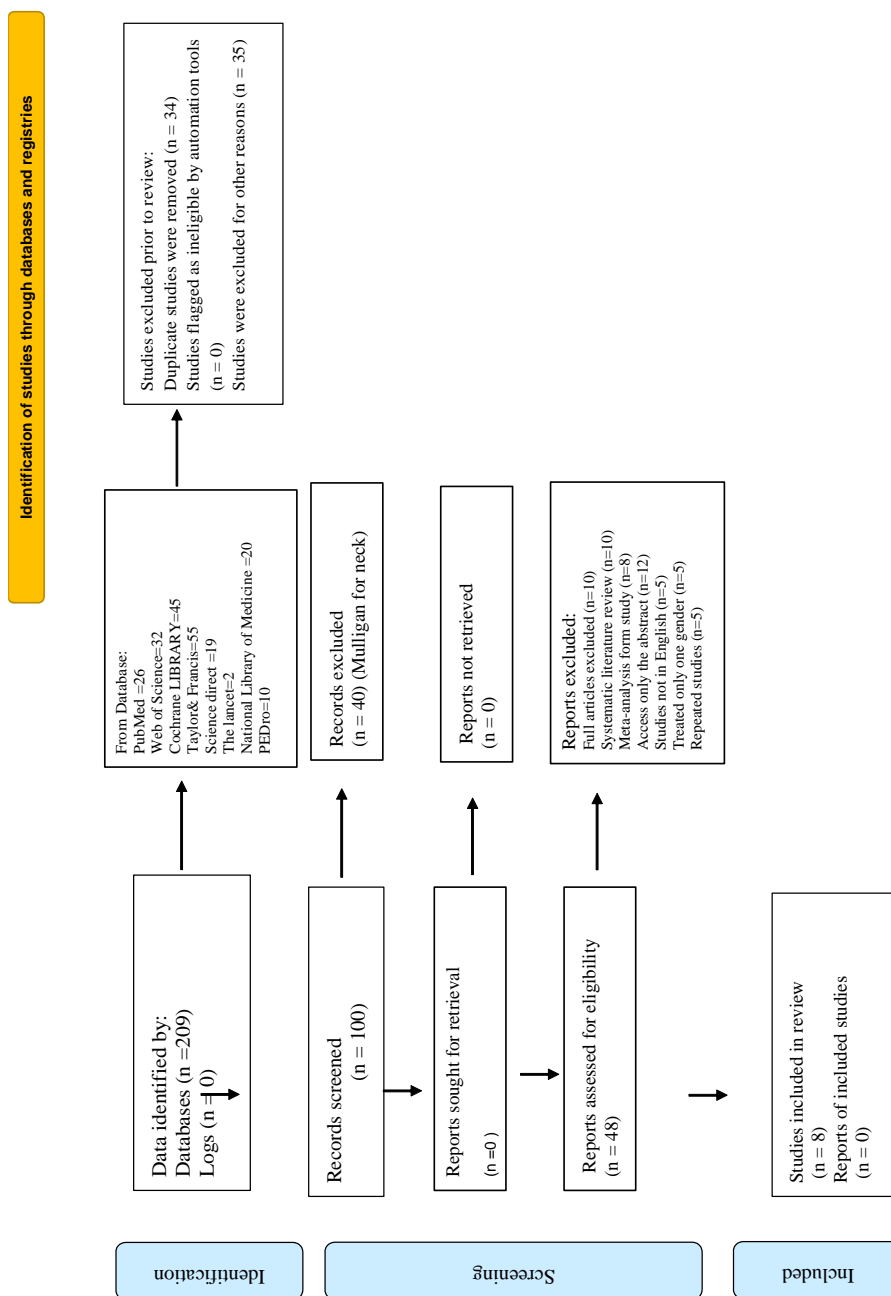
Table 1. General characteristics of the studies included in the literature review

Study	Design	Participants/Inclusion criteria	Intervention	Outcome measures	Results
1.Mubarra Rehman et al. (Fehler! Verweisquelle konnte nicht gefunden werden.) (2021)	RTC	Diagnosis PF pain. N=28 women, N=6 men. Age of participants 20-45 years.	Group A= MWM Mulligan with movement N=17; Group B= knee tape according to Mulligan N=17; Treatment for 2 sessions per week for 2 weeks	1. NPRS; 2. KPRS; 3. AKE; 4. TUG.	Group A had significant values, for pain with p values (value)=($p < 0.0001$). Group B had a significant improvement in flexibility with values p(value)= ($p < 0.0001$). There was a significant difference before and after the interventions in both groups. With the values p(value)= ($p < 0.0001$) in terms of measured variables (both Mulligan Techniques).
2.Konstantinos Zemadonis et al. (30) (2015)	RTC	Diagnosis patient with PF pain syndrome. N=38 participants; N=24 women, N=14 men Age (18–40 years).	Group A= MWM (for knee and C-F joint ion); Group B=MWM (for knee and C-F joint); Group A & B treatment 1 week. GroupC=MF; Group C treatment 6 weeks.	1.VAS; 2. Functional scale of the lower extremities (LEFS).	In Group A & B there were significant values in VAS and LEFS with values p(value)=($P < 0.001$) Compared to group C.
3.Robinetta Hudson et al. (31) (2018)	RTC	Patient diagnosed with meniscal fissure of the knee. N=23; 12 F & 11M Age of participants 14-62 years old.	GroupA = Technique MCS; Group B= Sham Technique; In both group they take treatment for 14 days in total only 6 sessions.	1. NRS; 2. PSFS; 3. DPA; 4. KOOS.	The Mulligan Concept technique is effective in patient-specific functional scale (PSFS) with values p(value) = $p < .001$. As well as in the disability of the active physical scale (DPA) there were significant differences between the two groups with values p(value)= ($p < .001$). Up to the 14-day period that the patients followed the treatment.

4. Madhura Bhagat et al (32) (2019)	RTC	Radiological diagnosis of knee OA. N=30; Age 40 years.	Group A=MWM Group B=Sham. They were treated for 3 sets of 10 repetitions.	1. NPRS; 2. TUG.	Significant results were in favor of the intervention group, on which Mulligan's Mobilization was applied. Values p(value) = (p < 0.05) both in terms of NPRS and TUG.
5. Hani A. Alkhawajah et al. (33) (2019)	RTC	Radiological diagnosis of OA N=40; Age of participants Age ≥40.	Group A=MWM, N=20; Group B=SHAM; N=20. Treatment time 3 sets with 10 repetitions.	1. VAS; 2. Pain threshold pressure (PPT); 3. WOMAC; 4. TUG; 5. knee strength; 6. ROM.	Mulligan's technique proves effective in connection with Sham in terms of: pain, PPT, TUG, muscle strength and ROM for the flexion movement only. With significant statistical values p(value)=p <0.001. On the other hand, MWM is not effective in terms of WOMAC index and articular amplitude in knee extension, where the values p(value)= (p ≥ 0.067)
6. Abbas Fadhil Taher et al. (34) (2023)	Clinical Trial	Diagnosis of chronic OA with pain for 1 year. N=15,F=15M The age of 35-40 years old.	Group A= N=15 (Technique MWM); Group B(MET) N=15. Treatment 3 sessions per week.	1. ROM; 2. VAS; 3. KOOS; 4. TUG;	There was a significant value for: Vas, KOOS, ROM with values p(value)=(P<0.001, P<0.001 P<0.002 in each Group in Mulligan Results were observed after treatment. While for the variable of TUG p(value) = P<0.008.
7. Javid Mostamand et al (35) (2023)	RTC	OA diagnosis. N=31. Age of participants unspecified.	N=16 (Group of MWM); N=15 (Group of TPF). Patients underwent treatment for 10 sessions.	1. VAS; 2. TUG; 3. OLS;	Significant results were assessed in the MWM group. Regarding the variables of VAS with values P(value)=(P<0.001). There was also a significant value for the TUG variable for assessing balance with p(value) (P=0.006).
8. Sumit Raghav et al. (36) (2018)	RTC	NA post LG. N=30, N=7 women, N=23 men, age 22-35 years	Group A (PWB)+(MWM) Group B (CPM) + (ROM) +(PWB). Treatment time 4 weeks.	1. VAS; 2. ROM;	There were significant results in terms of VAS and ROM variables in group A in which paraffin combined with MWM was applied with values p(value)=(p=0.001).

Abbreviations *RTC(randomized controlled trial), MWM(mobilization with movement), PF(patella-femoral pain), NPRS(the numerical pain rating scale), KPRS(Korean pain rating scale), AKE(active knee extension, VAS(visual analogue scale), LEFS (Lower Extremity Functional Scale), MF (physiotherapeutic modalities), TK (conventional therapy), FM (meniscus tear), ROM (range of motion), PSFS (patient specific function scale) , MCS (Mulligan concept squeeze technique), NRS (Numerical Rating Scale), DPA (Physical Active Disability Scale), KOOS (Knee Injury and Osteoarthritis Score), OA (Knee Osteoarthritis), TUG (up and go test), PPT(pain threshold pressure, WOMAC (Osteoarthritis index of Western Ontario and McMaster Universities), OLS (one leg stand test); TPF(general physiotherapy therapy), PWB(paraffin application), CPM (exercises for knee amplitudes + continuation of passive movements), NA (articular stiffness), LG (knee injuries)

Figure 1. Prisma 2020 flow diagram for new literature review studies that include searches only in databases and registers



Quality assessment Risk of Bias

Studies were evaluated using the PEDro scale. Of the included studies, 8 studies were randomized controlled trials studies (35,29,32,33,36,31,30)

and one was a clinical trial (34). Studies with ≥ 8 points are considered high quality, with 6-7 moderate, with ≤ 5 validity points as low quality.

Table 2. Characteristics of studies according to Pedro scale

Pedro Scale	1.Mubarra Rehman et al (2021)	2.Konstantinos Zemadanis et al. (2015)	3.Robinetta Hudson et al. (2018)	4.Madhura Bhagat et al (2019)	5.Hani A. Alkhawajah et al. (2019)	6.Abbas Fadhil Taher et al. (2023)	7. Javid Mostamand et al. (2023)	8. Sumit Raghav et al. (2018)
Eligibility	yes	yes	yes	yes	Yes	yes	yes	yes
Random allocation	yes	No	yes	yes	Yes	yes	yes	yes
Concealed allocation	yes	No	yes	no	Yes	yes	yes	yes
Baseline comparability	yes	yes	yes	yes	Yes	yes	yes	yes
Blind participants	yes	No	yes	yes	Yes	yes	no	no
Blind therapist	No	No	no	no	No	yes	no	no
Blind assessor	no	yes	no	no	Yes	no	no	no
Adequate follow-up	yes	yes	yes	yes	Yes	yes	yes	yes
Intention: to treat analysis	yes	yes	yes	yes	Yes	yes	yes	yes
Betweengroup comparison	yes	yes	yes	yes	Yes	yes	yes	yes
Point estimate and variability	yes	yes	yes	yes	Yes	yes	yes	yes
Total score	9	7	10	9	10	10	8	8

Statistical significance

Visualization of the risk of bias in the included studies for this literature review, used QUADAS-2 as a bias tool with data stored in excel table for the 8 studies (37). It was evaluated the way of involving patients, index, standard literature, time and flow of each study. We note that 7 studies out of 8 have low risk, no study has high risk of bias. Despite that during the search over 35 studies were identified that treated knee injuries with Mulligan's techniques and sub-techniques but only 8 were considered in more detail.

syndrome (30) with knee meniscal fissures (31), knee osteoarthritis (32,34,35,33) and post-traumatic stiffness of knee joint (36). The majority of studies evaluate the effectiveness of the Mulligan technique or concept in knee injuries compared to other techniques that have been applied in each of the randomized controlled trials. Most studies evaluated the effectiveness of the Mulligan Technique (concept) in terms of pain relief, increase ROM, increase functionality and muscle strength. In the study of Talasaki et al. (38), the effect of the mulligan MWM

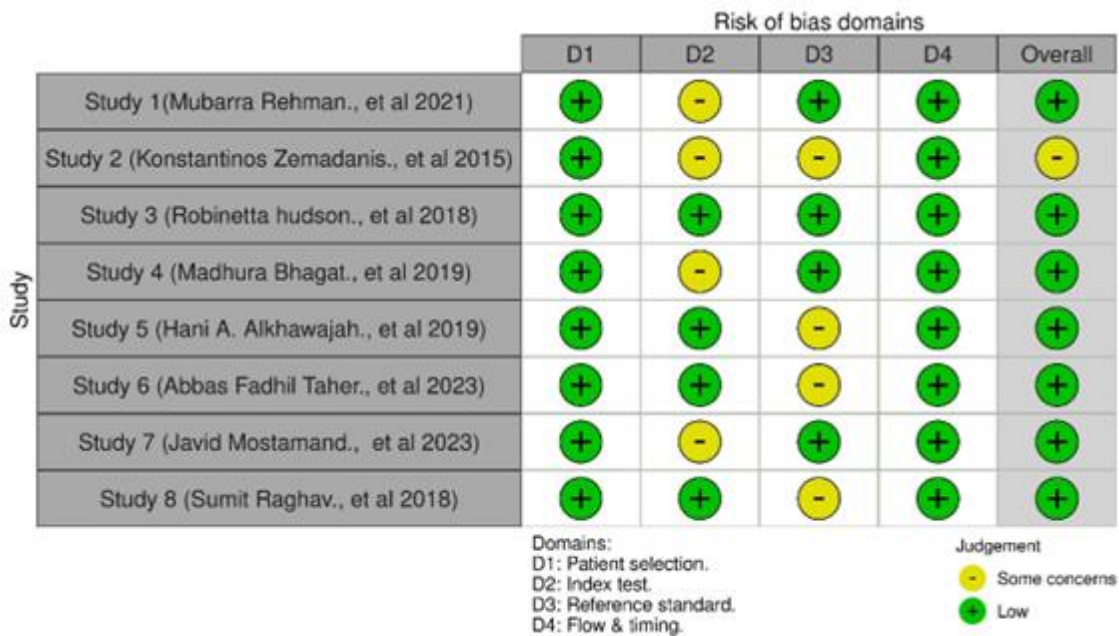


Figure 2. Specificity of each study for assessing the risk of bias

DISCUSSION

This literature review study including 8 randomized controlled trials and one clinical trial was designed to evaluate the effect of Mulligan's concept on knee problems or injuries in several situations. Starting with *patella-femoral* pain

technique in improving pain and functionality of patients with OA was significantly evaluated. As in the studies that treat osteoarthritis and are included in this literature review, the positive effect of MWM on pain, flexibility, muscle strength and functionality is evaluated

(32,33,34,35). While in other studies (39), Mulligan's MWM Technique was evaluated as effective during basketball player activities in daily activities and in reducing pain in athletes with tendinopathy. There were also effective results in Robinetta's study (40) in the treatment of meniscal injuries in athletes through Mulligan's Squeeze technique, improving pain and functionality. In one study (41), although the patients were female athletes, mulligan taping was effective in patients with patella-femoral pain in increase the knee flexibility. It should be underlined the fact that the significant impact of the Mulligan technique on knee injuries applies not only to the sport of basketball but also to other sports and professions. It was the study of Krzyzanowicz (42) in which the results followed significant values of pain reduction and functional recovery in 5 ballerinas suffering from patellar syndrome. The methodology of the eight studies were randomized and all studies used SPSS statistical analysis and the risk of statistical error was almost minimal despite the small number of participants in their studies.

CONCLUSION

This study evidences the effect that Mulligan's Technique (Concept) has in increasing some beneficial parameters in injuries or pathologies of the knee such as reducing pain, increase joint flexibility, increase muscle strength and functionality for the lower limbs. Improvement of all these elements were adequate for patella-femoral pain syndrome, knee meniscal injuries,

knee osteoarthritis and post traumatic stiffness of knee injuries. In the future research we expect to identify the same effects of the Mulligan technique in knee injuries among basketball players in Albania.

Limitation

In this literature review, randomized controlled trials studies did not evaluate patients based on the same outcome measures, there was a variety of them. Another limitation was the follow-up time, which was short from 3 sets of 10 repetitions to 6 weeks. A limited number of studies had the concrete effect of MWM on ACL injuries.

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Conflict of Interest Statement: The author declares that have no conflict of interest.

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