



# **Surgical Treatment versus Conservative Treatment for ACL rupture on female gymnasts. *A Study Protocol for a Randomized Controlled Trial***

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## ***Final Project***

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## **1. Acknowledgments**

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## **2. Abstract and Keywords**

**BACKGROUND:** An ACL injury is one of the most common and devastating sports injuries, and the incidence points to be much higher in females than in male counterparts. The incidence points to 2-8 times more likely to occur on female subjects . This study aimed to compare the effectiveness of a Surgical treatment of an Anterior Cruciate Ligament (ACL) rupture compared with a Non-surgical treatment to evaluate the function level of the knee in order to reduce the time taken to Return to Play and the continuity of the sportive practice in female gymnasts in the long term.

**METHODS:** This study is a study protocol for a Randomised Controlled Trial, with repeated assessment at the beginning and end of the treatment posterior to the injury and a minimum of 5 years follow up of sporting activity. The inclusion criteria for the participants will be female athletes from different sport centers in Barcelona that suffered an ACL rupture, age from 14-19 due then during this period the risk seems to be at its peak with a level III of ACL injury. The treatment will be divided into “Control Group” (Surgical treatment of ACL rupture + Physical Therapy) and “Treatment Group” (Physical Therapy or Non-surgical treatment of ACL rupture). The outcomes will be measured with the International Knee Documentation Committee (IKDC) questionnaire and the Anterior Cruciate Ligament Return to Sport After Injury (ACL - RSI) to measure functionality and stability of the joint and the time that takes to reach this maximum level.

**DISCUSSION:** It is expected to find higher levels of function on the Treatment Group with the Conservative treatment in order to achieve a decreased time to return to play, compared to the Control group that will follow a Surgical treatment + Physical Therapy. It is also expected to find that the Treatment group will have a greater percentage of individuals that keep practicing the sport in the long term.

**Keywords:** ACL rupture, Return to play, Female athletes, Surgical treatment, Non-surgical treatment.

### **3. Introduction**

According to a global consensus, a rupture of the Anterior Cruciate Ligament (ACL), which is a very strong structure that is in charge to connect the femur (thigh bone) to the tibia (shin bone), is a serious injury affecting the knee. The specific function of this ligament is to manage how forward the tibia can “slide” relative to the femur. This condition mainly affects physically active young people, or people that practice sports that involve sudden stops or change in directions. When this structure gets injured it clearly affects knee stability, and it's closely related with an increased risk of developing post-traumatic knee osteoarthritis (1).

The ACL injuries are common lesions among athletes, most frequently in sports related with pivot movements such as soccer, basketball or in gymnastics. The incidence rate is remarkably high especially in young athletes aged 14-19 y.o. (2). The injury can be made by direct contact, indirect contact and with no contact, being the non contact mechanism the primary cause of anterior cruciate ligament injury in sports (3) and compared with males, non contact injuries to the ACL is 3.5 times bigger (4). It is also divided into 3 levels; Grade I which is a minimum sprain with some damage on the fibers of the ligament, Grade II for a partial tear of the tendon and Grade III for a complete tear of the structure, and can be found with concomitant injuries in some other structures of the joint such as meniscal and medial ligament injury or even in some rare situations accompanied with avulsions. Moreover, some studies have found that a non contact ACL injury seems to be more recurrent in female athletes than male athletes, with an incidence of 2-9 and average increased incidence of 3.5–4 higher in women (5). However, despite this fact, in the literature we find very little studies on female athletes, which is why we will also use some studies on males patients to complete the study protocol.

Rather to be related with the nature of the sport as globally is supposed, some injuries like ACL rupture point to be more closely related to the gender of the athlete, but it is important to mention that the type of sport they practice will always influence the mechanism for the injury. Female athletes that practice sports like soccer, basketball, gymnastics, handball, volleyball and skiing seem to be the most affected

population for ACL injury and severe knee injuries in general. An increased rate of second ACL injury after ACL reconstruction exists in athletes when compared with a healthy population. Female athletes suffer contralateral ACL injuries at a higher rate than male athletes and seem to suffer contralateral ACL injuries more frequently than graft re-tears. (6)

Related to the causes or risk factors pointed to the ACL rupture we found an increase in risk on female sex, genetic predisposition and prior reconstruction of the ligament. Some authors have studied if a very increased anterior laxity may predispose the subjects to have a ligamentous injury which seems viable only in a prospective way (7), but no deep correlation was found on female gymnastics. In contrast, and related to the gender which is the most interesting point for this review, in some studies that compare male with females, some intrinsic factors have been found such as the use of different movement and muscle activation patterns, differences on quadriceps angle, posterior tibial slope, ACL cross-sectional area predisposes women to have an ACL injury more frequently than men. Other study pointed to more intrinsic risk factors directly related with woman physiology including; [1] being in the preovulatory phase of the menstrual cycle compared with the postovulatory phase; [2] having decreased intercondylar notch width on plain radiography; and [3] developing increased knee abduction moment (a valgus intersegmental torque) during impact on landing (2), but in contrast with the first point of the preovulatory phase, other studies found no conclusive link has been made between ACL injury and the menstrual cycle (8).

ACL injuries are characterized for being immediately disabling directly affecting joint stability and are closely associated with long-term consequences, such as we mentioned before posttraumatic osteoarthritis (OA), degradation of other structures such as the meniscus, decreased joint space and a reduced function compared with the contralateral side. Many patients undergoing an ACL injury do not return to sports after rehabilitation, or do not return to the previous level, many times due to the fear of reinjury. A systematic review investigated the rate of return to sports after reconstruction and reported 82% of participants return to sports, 63% returning to pre-injury level with only 44% having returned to competitive sport despite successful outcome on knee impairment-based function scales (9). As we know there are many psychological aspects linked to injuries in general, being healthy does not limit just to

physical weakness or healing. Fear of reinjury, lack of psychological readiness or even the impatience for being ready to return to sports, are important aspects to treat in rehabilitation to keep our patients on the right track. A study of 164 patients were interviewed after an ACL injury, 50% of them did not return to their sports or recreational activity, The main reasons for not returning were not trusting the knee (28%), fear of a new injury (24%) and poor knee function (22%), psychological readiness can be a crucial factor for return to sports results. (10)

This trial article will compare two treatments for an ACL rupture, the first one will be the Surgical treatment, which according to the literature and regular practice is the most indicated for young active people which includes our population, however, it is important to mention that surgical reconstruction of the ACL has not been shown to reduce the risk of future osteoarthritis (OA) (1) nor other long term risk with big scientific background and also no difference in osteoarthritis after surgical and non-surgical treatment of ACL-injured knees after 10 years were founded on the literature (11). According to several studies, surgical reconstruction of the ACL is the most accurate treatment to restore the stability of the joint and keep full ROM. The criteria to undergo this treatment generally is being younger than 25 y.o, being highly active, have intra articular damage or a noted anterior tibial subluxation, but anyways, the treatment option must always be assessed under patient basis. It's also important to mention that there is no evidence in the literature that clearly highlights one intervention above another in the general basis, in general no big differences were evidenced.(12) (13)

There is no gold standard for ACL reconstruction, techniques can vary as do the graft materials. Different techniques include intra-articular versus extra articular surgery, open versus arthroscopy interventions, and some recent studies point to “All inside ACL surgery”, which is quite new on the field, related with decreased postoperative pain due to the bone remaining unaltered but may have a higher risk of graft failure, more studies are required to conclude. (14). Related to the graft material, there are also several options and each one of them have their own pros and cons; Hamstring tendon, Patellar tendon, Cadaver graft and LARS which is an artificial graft. The decision of the graft should always be the most adequate for the patient. The literature that concludes the Operative treatment more favourable in the

long term, includes de Conservative treatment as the option with a poorest outcome in terms of stability and function. (15)

Whether surgical or conservative treatment is more effective in terms of allowing patients to return to physical activity after anterior cruciate ligament (ACL) injury is controversial. (16) Even though there are many studies that support the Surgical treatment, there are some points to be discussed in terms to be the most adequate for the patient, such as the time for recovering due to the wound that needs to close before treatment starts and this can be a disadvantage for an athlete. Depending on the graft, some difficulties can appear; if the graft is from a deceased donor, the body can reject it, if it's a LARS it does not dissolve with time, and if it's a Hamstring or patellar tendon, there's another wound to heal and another structure that the body needs to repair and can remain weaker compared to the contralateral side and must also be strengthened in rehabilitation. Related to the surgical technique, the disadvantages are related with the bone, due that in most of the techniques the need to create a tunnel to attach the new tendon is required. Although it seems to be the most trustful option in terms of functionality and stability, the rate of recurrence is still very high, pointing the first 24 months after surgery the most risky for reinjury.

Surgical management can be highly costly and time consuming for our population and for athletes in general.

On the other hand, the Treatment group rehabilitation will be the Non-surgical treatment, which is the one that has less support in the literature for the population that is treated in this study. Normally this type of treatment is advised for older patients that are not physically active, with no relevant intra articular damage and inexistent or minimal anterior tibial subluxation. The main focus of the rehabilitation will be the strengthening of muscles through therapeutic exercises to restore anterior-posterior and rotational joint stability as much as possible, always trying to reach the closest functionality compared to the healthy side. Despite the success of the treatment, speaking in long terms, sometimes joint mechanisms after the injury may not be sufficient for returning to sports in a professional way, but a study for non-operative course of rehabilitation after anterior cruciate ligament injury for those looking forward to returning to pivoting and cutting sports. shows that the conservative treatment is reliable (17)



There is a very controversial view when both treatments are compared, some literature consider that the evidence of the surgical treatment over the conservative is very weak and insufficient to conclude that Surgical management of ACL rupture produces better results. On the other hand there are studies that point to the benefits of a Non-operative treatment. The “rule of thirds” was first described by Noyes et al. in 1983. and stands that at least  $\frac{1}{3}$  of patients treated with a conservative treatment will benefit from it without major instability by modifying activity patterns. (18)

As far as it is known, the information given in the literature is controversial and not sufficient to make a favourable correlation for the Standard treatment of the ACL rupture in our population. In any case, none of these treatments seems to have a potential hazard related to the safety and integrity of the knee joint, depending on where the perspective is set, one or the other can fulfill better expectations related to the goals for the rehabilitation.

Following this idea, this study is made to correlate both Surgical and Conservative treatment with parameters that are crucial for young athletes, specifically female gymnastics that are interested in the prosperity of their career in sports. The first goal is to determine which treatment is the most indicated to get a shorter time to Return to Sport, the particular reason for this circumstance is the interest of the athlete to return sooner to a normal practice, or competition. The second goal is to establish which treatment is the most indicated to guarantee better chances of integrity of the joint and all the structures that compose it to keep practicing in a professional way in the future.

The purpose of this trial is to conclude if a Conservative management of an Anterior Cruciate Ligament rupture should be able to fulfill both goals with better results than a Surgical intervention.

#### **4. Hypothesis**

##### H0 or Null Hypothesis:

Non-surgical treatment will have the same results as the Surgical treatment related to the functional levels of the knee and continuity of practice in the long term for the ACL injury on female gymnasts.

##### H1 or Alternative Hypothesis:

Non-surgical treatment will have higher levels of knee function and will have a better percentage on individuals that keep practicing gymnastics in the long term than the Surgical treatment in the treatment of ACL on female gymnasts.

#### **5. Objectives**

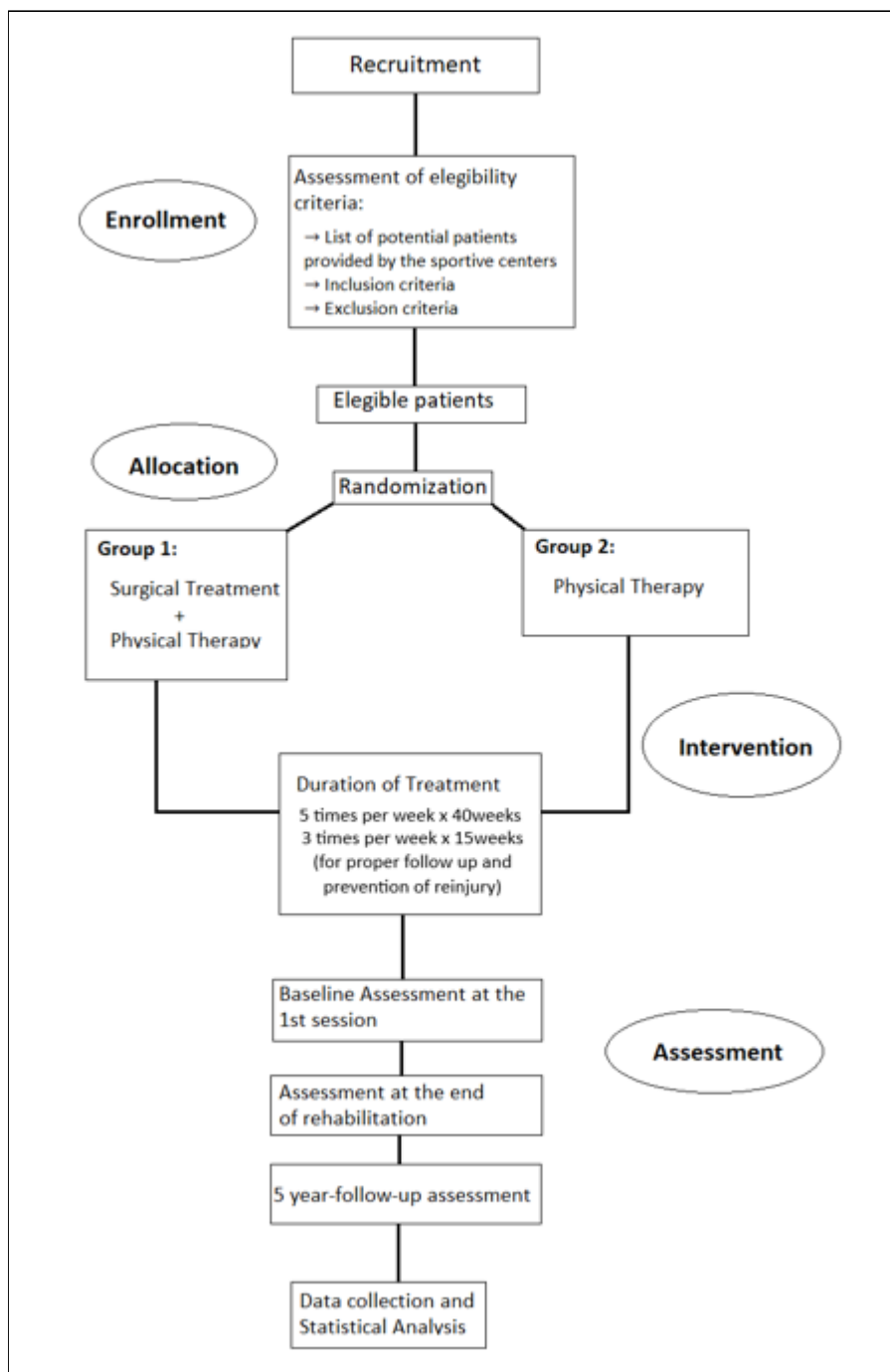
The primary objective of this study is (1) to determine whether Conservative Treatment provides better results related to self-reported knee function than Surgical+Conservative Treatment on female gymnasts with ACL rupture. (2) The secondary outcome is to evaluate if the same intervention (Conservative treatment) will also guarantee a bigger percentage of patients that keep practicing gymnastics in the long term after suffering an ACL rupture.

## 6. Methods

### 6.1 Study Design:

This study will be a multi-centered single blinded controlled trial (RCT). It will consist of two intervention groups; a control group that will receive a surgical treatment + physical therapy and an Treatment group which will undergo a physical therapy treatment without a surgical intervention.

### 6.2 Flow Diagram of the Study Design:



### **6.3 Setting & Recruitment:**

This study will be performed in a sportive physiotherapy clinic in Barcelona. Patients meeting the eligibility criteria from different gymnastic/sportive centers located in Barcelona will be contacted via phone call by our researchers to be informed about the procedures, in the case that the patients are under 18 years old, the parents or legal tutor will be the one that will decide. Once they agree an informed consent will be sent via email.

### **6.4. Sample size:**

In this study we will use the International Knee Documentation Committee (IKDC), and the Anterior Cruciate Ligament to Return to Sport after Injury (ACL-RSI) in order to evaluate the levels of knee function. The Minimal Clinically Important Difference For IKDC is [MCID = 9.8 - 26.9] (19). And for the ACL-RSI the [MCID =  $\geq 1.9$ ] respectively.(20)

### **6.5. Eligibility criteria, Participant, Inclusion and Exclusion criteria:**

#### **Inclusion Criteria**

- Bein female
- Aged between 14-19 years old
- Practice gymnastics in a professional way for at least 3 years
- Suffer a complete ACL rupture

#### **Exclusion Criteria**

- Patients with comorbidities in surrounding structures of the knee that can affect the outcomes of the study
- Being under age with no parental consent
- Lack of participation or non-cooperative patients will be excluded of the study
- Missing at least 2 session will also exclude the patient from the study

## **6.6 Randomization:**

The patients will be divided into 2 groups, being “Control Group” Surgical intervention of the ligament + Physical Rehabilitation and “Treatment Group” will receive only Physical Rehabilitation. Randomization process will be performed by a person who will not participate in the study to reduce the selection bias.

## **6.7. Blinding:**

This study will be a single-blinding study. A physiotherapist will assess the outcomes. It is worth mentioning that to avoid bias, this person will not be present in the selection process nor the treatment.

## **6.8. Interventions:**

### **1) Control Group**

The intervention of the Study Group will be the surgery of the anterior cruciate ligament and after the physical rehabilitation.

There is evidence suggesting that preoperative rehabilitation is beneficial to patients with anterior cruciate ligament injury (21). For the maximum benefits of surgery this group will undergo a pre rehabilitation, the more functional and stronger the injured knee is before surgery, the further ahead will be reached after in rehabilitation. The goals for the prehabilitation will be to achieve full extension of the injured leg and walk as much as normal as possible. We will make this possible by strengthening the surrounding muscles, especially the Quadriceps muscle, increase the range of motion and blood flow around the knee to promote healing. Once the goals are reached the surgery comes next. In this study we will follow the MOON pre-rehabilitation program prior to the surgical intervention (*annexe 1*)

There are many variations for ACL reconstructions, the variations depend on what the graft, the new tendon, is made of. There are four main graft options; Patellar autograft, Hamstrings autograft, allografts and LARS. The autograft comes from the patient's own body, the allograft comes from a cadaver donor and the LARS are made of synthetic material. While extensive studies have studied the effectiveness of a graft over another, it is important to discuss the patients preferences, age, lyfestyle

and familiarity of the surgeon with a certain type of graft before making the decision. Each of the grafts have main advantages and disadvantages looking from a physiological and functional perspective.

In general, allografts are not quite as strong as a patient's own tissue (autografts), but can work at a very high level for a non-competitive athlete. One of the advantages is that it doesn't need extra incisions because the tissue comes from someone else, so the operative time is decreased. A disadvantage on this aspect will be that there is always a minimum risk for infection, but sterilization makes this risk very small. Although, early reviews have indicated a higher risk of failure with allografts due to association with irradiation for sterilisation and where rehabilitation programs and post-operative loading may ignore the slower incorporation of allografts. And less inferior outcomes have been reported in young active people (<25).(20)

With synthetic graft (LARS), one of the main disadvantages is that the implant does not dissolve with time and requires a higher surgical experience with the technique and the material, it is also associated with a high failure rate at minimum of 6 years follow up with a 33.3% of construction failure (21)

For our target population, it is more recommendable to perform an ACL reconstruction with autografts, because these have very good pros such as; biological precedence, are fully replaced by new tissue over time. For the Hamstring autograft, apart from the previous pros that are mentioned, the scar that produces is relatively small and causes no irritation. On the other hand the disadvantages come when we talk about the strength of the graft, it is relatively weaker and it might stretch, it also produces a weakness in the hamstrings, which is important to have in mind during rehabilitation.

For the Patellar graft, the pros are shared with the Hamstring tendon graft, but this one as it is mentioned before is stronger, the disadvantages are associated with a scar tissue that causes irritation especially at kneeling and the weakness produced after surgery of the patellar tendon and bone.

Based on the results of a study that compares both autografts, Hamstring tendon autograft (HT) is comparable with the Patellar tendon autograft (BPTB) in terms of clinical function, postoperative kneeling stability and OA signs. But the HT autograft carries a lower risk of complications, such as anterior knee pain and kneeling and

extension loss but an increased incidence of graft failure (OR = 0.59, 95%CI: 0.38-0.91, P = .02). (22)

The second intervention of the Study group is the Physical therapy that will start a few days after the intervention as long as the wound is properly healed and no risk of opening are presented. For this stage we will follow the MOON protocol (*annexe 1*).

Funded by subsidies from the National Institutes of Health, which is part of the US Department of Health and Human Services. The MOON protocol has five phases and a pre-surgery phase. Each one has their own specific goals, exercises and instructions. The majority of the patients following this program achieved approximately 90% of their original functionality. Also following the return-to-sport program, patients are able to reduce the risk of reinjury by 40-60% (24) At the end of the physical therapy the patients will start the return-to-sport.

The rehabilitation intervention is described in detail below in the Treatment section.

## **2) Treatment Group**

The Treatment Group will follow the MOON protocol that will also be applied to the Control Group, excluding the preoperative phase due to the absence of that intervention in these groups and also keeping the return-to-sport exercises at the end of the physical rehabilitation.

As we mentioned before the MOON protocol consists of five major phases, each one with their specific goals. The protocol has been made to service the entire spectrum of ACL injured people from non athletes to elite athletes. The multicenter nature of the MOON protocol requires that the rehabilitation is made only by treatment methods that can be done in any place without any expensive equipment. For this reason some treatment methods such as Electrical Stimulation, Water therapy, etc are not included, because the expert panel of this program believes that it is unreasonable to demand the use of these methods if it's possible to carry on a successful rehabilitation without them avoiding the expenses of their use.

Progression from phase to phase is based on the patient's readiness to achieve functional criteria rather than in time. There are timeframes that are suggested as an average, not a guideline for progression. Some patients can be ready to progress to the next phase sooner than the timeframe suggested, and other patients will take longer.

Each phase of the protocol is fully described in the annexes section. (*Annexe 1*)

→ **Phase 0: Preoperative Recommendations** (*Only for Control Group*)

Goals:

- Normal Gait
- AROM 0-120° of flexion
- 20 SLR of strength without lag
- Minimal effusion
- Patient education on post-operative exercises and need for compliance
- Educated in ambulation with crutches
- Wound care education
- Moon follow-up expectation clear

→ **Phase 1: Immediate Post-operative Phase** (*Timeframe: Surgery to 2 weeks*)

Goals:

- Full knee extension ROM
- Good quadriceps control ( $\geq 20$  no slag SLR)
- Minimize pain
- Minimize swelling
- Normal gait pattern

*Criteria for progression to phase 2:*

- 20 no slag SLR
- Normal gait
- Crutch/Immobilizer D/C
- ROM no greater than 51 active extension, 110° active flexion

→ **Phase 2: Early Rehabilitation Phase** (*Timeframe: weeks 2 to 6*)

Goals:

- Full ROM
- Improve muscle strength
- Progress neuromuscular training

*Criteria for progression to phase 3:*



- Full ROM
- Minimal effusion/pain
- Functional strength and control in daily activities
- IKDC Question #10 (Global Rating of Function) score of  $\geq 7$

→ **Phase 3: Strengthening & Control Phase** (Timeframe: weeks 7 through 12)

Goals:

- Maintain full ROM
- Running without pain or swelling
- Hopping without pain, swelling or giving-way

*Criteria for progression to phase 4:*

- Running without pain or swelling
- Hopping without pain or swelling (Bilateral and Unilateral)
- Neuromuscular and strength training exercises without difficulty

→ **Phase 4: Advanced Training Phase** (Timeframe: weeks 13 to 16)

Goals:

- Running patterns at 75% speed without difficulty
- Jumping without difficulty
- Hop test at 75% contralateral values (Cincinnati hop tests: single-leg hop for distance, triple-hop for distance, crossover hop for distance, 6-meter time hop)

*Criteria for progression to phase 5:*

- Maximum vertical jump without pain or instability
- 75% of contralateral on hop test
- Run at 75% speed without difficulty
- IKDC Question #10 (Global Rating of Function) score of  $\geq 8$

→ **Phase 5: Return-to-Sport Phase** (Timeframe: weeks 17 to 20)

Goals:

- 85% contralateral strength
- 85% contralateral hop test

- Sport specific training without pain, swelling or difficulty

*Return to sport evaluation recommendations:*

- Hop tests (single-leg hop, tiple hop, crossover hop, 6 meter timed-hop)
- Isokinetic strength test (60°/second)
- Vertical jump
- Deceleration shuttle test
- MOON outcomes measure packet (mandatory; should be completed post-testing)

→ **Return to Sport Criteria**

- No functional complaints
- Confidence when running, cutting, jumping at full speed
- 85% contralateral values on hop tests
- IKDC Question #10 (Global Rating of Function) score of  $\geq 9$

**6.9. Outcomes:**

Patients will be assessed at the beginning of the study (week 0), at the end of the study (week 40), and 5 years after, we will also make measurements throughout the entire process to see how the patient is improving. The first outcome is the level of knee function, we are looking for the maximum possible in order to start the Return to Play process as soon as possible. This outcome will be measured by the International Knee Documentation Sport (IKDC) and the Anterior Cruciate Ligament Return to Sport After Injury (ACL - RSI) to measure function perceived by the patient at each point.

The adherence to the treatment will be measured by an assistance sheet that each patient will sign at the beginning of every session.

Regarding the secondary outcome, that is the continuity of gymnastics, we will contact each patient 5 years after and ask him directly about his participation in the sport, and in the case of no continuity of practice we will also ask the reasons, if they are related with knee injury will count for the statistics and will not count if there are other personal reasons but the patient is able to practicing if wishes.

The assessor will realize all the measurements face to face in both groups to make sure there's no inter-rater bias. At the end of all the measurement periods the assessor will complete an Excel document with a list of numbers corresponding to patients with the corresponding score on each test, then that sheet will be sent to the statistician for the following steps.

### **6.10. Assessments:**

The outcomes will be assessed two times during the study and one time after a minimum of 5 years. The baseline assessment will be performed at the beginning of the Physical rehabilitation, for the Control Group this will be when the wound is completely close to avoid openings. Then, we will assess the results of the treatment at the end of the Physical rehabilitation to compare both results in both groups and the third time will be after 5 years to compare the continuity in the practice.

To assess the primary objective: “Level of Knee Function”

We will use the International Knee Documentation Committee (IKDC) Questionnaire, which is used to evaluate knee function perceived by the patient and the score ranges from 0-100. (*Annexe 2*).

At the same time we will perform Anterior Cruciate Ligament Return to Sport After Injury (ACL - RSI) which is predictive for successful return to sport. (*Annexe 3*)

To assess the secondary objective: “Continuity into the practice”

This part of the outcome assessment will be performed by a simple questionnaire that the patient will answer. (*annexe 4*)

### **6.11. Statistical Analysis:**

There will be four outcome variables, the Knee function measured by the International Knee Documentation Committee (IKDC), and the Anterior Cruciate Ligament Return to Sport after Injury (ACL-RSI), the continuity of the sport practice and the adherence to the treatment. Statistical Software will be used for this part of the study and will be chosen by the statistician.

The statistics test used for (IKDC) and (ACL-RSI) and the adherence to the treatment will be the Student's t-test for two samples in order to compare means of

these variables in both groups as they are quantitative data and we need to obtain a final numerical score.

For the continuity into gymnastics the statistical test that we will use is the Chi-squared test, in order to compare if the categorical variables differ from each other, we will use this test because the outcome belongs to a qualitative data.

To counteract the issue of multiple comparisons we will perform a Bonferroni procedure.

We will set a  $\alpha$ -value of 0.05 and a  $\beta$ -value of 0.08 for the statistical significance. A Mean +/- Standard Deviation will be presented at any comparison.

## **7. Ethics**

This project will be performed under the four basic principles of research; respect of the individual, beneficence, no-maleficence and justice. It will be evaluated by the Ethics Committee of the sportive centers involved in the research. It will strictly cover the rules for a good clinical practice. The principles set in the Helsinki Declaration (World Medical Association, 1989) will be followed.

The informed consent will be mandatory and requested to all participants of the study. This informed consent includes detailed information about the research, clear and precise information about procedures and steps of the project, and any further question can be explained by the researchers. The informed consent also exposes that the participation for the study is voluntary and that the patient can quit at any point of it.

## 8. Project Calendar

	Study Period				
	Enrollment	Allocation	BASELINE	END OF INTERVENTION	FOLLOW UP
TIMEPOINT	-T1	0	T1 = Beginning of intervention	T2= End of intervention	Tx= 5 years post intervention
ENROLLMENT					
Eligibility Screen	x				
Informed Consent	x				
Allocation		x			
INTERVENTION					
Study Group					
Comparison Group					
ASSESSMENT					
IKDC			x	x	x
ACL - RSI			x	x	x

## 9. Limitations

Concerning the Physical therapy, there may be some limitations related to the delivery of the treatment. We will have 2 physiotherapists performing the same maneuvers, techniques and exercises but as every person has their own formation

and experience there can be a difference between the results given by this part of the treatment. In real life this commonly happens.

Another limitation will be related to the patientes, very similar with what happens with the physiotherapist, every patient will have a particular result from the treatment that will be linked to the level of commitment and participation, personal lifestyle and mindstate. In case that we have under age patients, parents being too involved in the treatment or with intrusive behaviour may also create some deficiency in the final result.

And lastly, the Groups 1 may have more dropping due to the waiting after surgery. Adherence to the treatment has to be controlled closely and the patients will be informed that the absence of 2 sessions will be a reason to be excluded from the study.

The patients will have the option to access surgery at any point of the study, if they change their mind and decide to undergo surgery this will become a limitation. But some previous studies have been performed the same way. (25)

## **10. Role of the investigators**

The investigator participating in this study will be 5, and all of them will be physiotherapists. The first will take the role of Investigator, his job will be to make the contact with the sportive centers, recruit the patients and perform the allocation and randomization process via software program and Excel sheets, he will also be in charge that all the ethics and criteria points are successfully followed. This investigator will not participate in any other point of the treatment.

The second will be in charge of the delivery of treatment in Group 1 and the third physiotherapist will be in charge of delivering the treatment in Group 2.

Another researcher will be the assessor, responsible to carry out the assessments.

At the end of the study the statistician will perform the Statistical Analysis and see to conclude if the interventions were effective or not.

## **11. Resources**

The materials used for this study will be divided into 3 groups; Fungible, Non Fungibles and Human resources.

### **Fungible Materials:**

- Oil or cream massage in case that the physiotherapist requires it during treatment.
- Towel or protective paper for physiotherapist table
- A pen to fill the patients information
- Bandages or compression bandages in case that is necessary

**Non Fungible Materials:**

- Physiotherapy table
- Sport materials (elastic bands, balls, cones, mat, etc), for treatment and for home exercises
- Computer with Allocation program and Excel

**Human Resources:**

- 4 physiotherapists with a minimum of 5 years of practical experience that will be in charge of different parts of the study. (Investigator, assessor, statistician and 2 rehabilitators)

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## 13. Annexes

### (1) Moon Protocol


Created by:

**M.O.O.N. Team**  
*Multicenter Orthopaedics Outcomes Network*

M.O.O.N. Team members



Updated 9/2017



# Advocate Medical Group

## Complete Orthopaedic Care

### MOON ACL Rehabilitation Guidelines

**General Information:** The following ACL rehabilitation guidelines are based on a review of the randomized controlled trials related to ACL rehabilitation. For many aspects of ACL rehabilitation there are either no studies that qualify as “best-evidence” or the number of studies is too few for conclusions to be drawn with confidence. In these circumstances, the recommendations are based upon the guidance of the MOON panel of content experts.

The guidelines have been developed to service the spectrum of ACL injured people (non-athlete ↔ elite athlete). For this reason, **example exercises** are provided instead of a highly structured rehabilitation program. **Attending rehabilitation specialists should tailor the program to each patient’s specific needs.**

The multi-center nature of the MOON group necessitates that the MOON ACL Rehabilitation Program only include treatment methods that can be employed at all sites without purchasing expensive equipment. Consequently, some treatment methods with supporting evidence (e.g., using a high-intensity electric stimulation training program for strength, aquatic therapy) are not included in the program because the expert panel believed that it is unreasonable to expect all sites to carry out such treatments.

Progression from one phase to the next is based on the patient demonstrating readiness by achieving **functional criteria rather than the time elapsed since surgery**. The timeframes identified in parentheses after each Phase are *approximate* times for the average patient, **NOT** guidelines for progression. Some patients will be ready to progress sooner than the timeframe identified, whereas others will take longer.

The *recommended* number of visits to the rehabilitation specialist (including visits merely for evaluation / exercise progression) is **16 to 24 visits** with the majority of the visits occurring early (**BIW x 6 weeks**). However, it is recognized that some patient’s health plans are severely restrictive. For this reason, the *minimum* number of post-ACL reconstruction visits to a rehabilitation specialist has been set at **6 visits** for the MOON group patients.

**\*\*\*If the patient underwent ACL reconstruction with meniscus repair, please maintain non-weight bearing with ROM 0-90 supine for the first 4 weeks, PWB with ROM 0-120 until week 6, then WBAT with full ROM beginning at week 6.**

Domont

**Phase 0: Pre-operative Recommendations**

- Normal gait
- AROM 0 to 120 degrees of flexion
- Strength: 20 SLR with no lag
- Minimal effusion
- Patient education on post-operative exercises and need for compliance
- Educated in ambulation with crutches
- Wound care instructions
- Educated in MOON follow-up expectations

**PHASE 1: Immediate Post-operative Phase** (Approximate timeframe: Surgery to 2 weeks)

**GOALS**

- Full knee extension ROM
- Good quadriceps control ( $\geq 20$  no lag SLR)
- Minimize pain
- Minimize swelling
- Normal gait pattern

**Crutch Use:** WBAT with crutches (beginning the day of surgery)

**Crutch D/C Criteria:** Normal gait pattern

Ability to safely ascend/descend stairs without noteworthy pain or  
Instability (reciprocal stair climbing)

**Knee Immobilizer:** None (Exception: First 24 hours after a femoral nerve block)

**Cryotherapy:** Cold with compression/elevation (e.g. Cryo-cuff, ice with compressive stocking)

- First 24 hours or until acute inflammation is controlled: every hour for 15 minutes
- After acute inflammation is controlled: 3 times a day for 15 minutes
- Crushed ice in the clinic (post-acute stage until D/C)

**EXERCISE SUGGESTIONS**

**ROM**

- *Extension:* Low load, long duration (~5 minutes) stretching (e.g., heel prop, prone hang minimizing co-contraction and nociceptor response)

- *Flexion:* Wall slides, heel slides, seated assisted knee flexion, bike: rocking-for-range
- Patellar mobilization (medial/lateral mobilization initially followed by superior/inferior direction while monitoring reaction to effusion and ROM)

#### Muscle Activation/Strength

- Quadriceps sets emphasizing vastus lateralis and vastus medialis activation
- SLR emphasizing no lag
- **Electric Stimulation:** *Optional* if unable to perform no lag SLR

**Discontinue** use when able to perform  
*20 no lag SLR*

- Double-leg quarter squats
- Standing theraband resisted terminal knee extension (TKE)
- Hamstring sets
- Hamstring curls
- Side-lying hip adduction/abduction (Avoid adduction moment in this phase with concomitant grade II – III MCL injury)
- Quad/ham co-contraction supine
- Prone Hip Extension
- Ankle pumps with theraband
- Heel raises (calf press)

#### Cardiopulmonary

- UBE or similar exercise is recommended

**Scar Massage** (when incision is fully healed)

#### CRITERIA FOR PROGRESSION TO PHASE 2

- 20 no lag SLR
- Normal gait
- Crutch/Immobilizer D/C
- ROM: no greater than 5° active extension lag, 110° active flexion

**PHASE 2: Early Rehabilitation Phase** (Approximate timeframe: weeks 2 to 6)

#### GOALS

- Full ROM
- Improve muscle strength
- Progress neuromuscular retraining

## EXERCISE SUGGESTIONS

### ROM

- Low load, long duration (assisted pm)
- Heel slides/wall slides
- Heel prop/prone hang (minimize co-contraction / nociceptor response)
- Bike (rocking-for-range → riding with low seat height)
- Flexibility stretching all major groups

### Strengthening

#### *Quadriceps:*

- Quad sets
- Mini-squats/wall-squats
- Steps-ups
- Knee extension from 90° to 40°
- Leg press
- Shuttle **Press without jumping action**

#### *Hamstrings:*

- Hamstring curls
- Resistive SLR with sports cord

#### *Other Musculature:*

- Hip adduction/abduction: SLR or with equipment
- Standing heel raises: progress from double to single leg support
- Seated calf press against resistance
- **Multi-hip machine in all directions with proximal pad placement**

### Neuromuscular training

- Wobble board
- Rocker board
- Single-leg stance with or without equipment (e.g. instrumented balance system)
- Slide board
- Fitter

### Cardiopulmonary

- Bike
- Elliptical trainer
- Stairmaster

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### CRITERIA FOR PROGRESSION TO PHASE 3

- Full ROM
- Minimal effusion/pain
- Functional strength and control in daily activities
- IKDC Question # 10 (Global Rating of Function) score of  $\geq 7$   
(See page 9)

**PHASE 3: Strengthening & Control Phase** (Approximate timeframe: weeks 7 through 12)

### GOALS

- Maintain full ROM
- Running without pain or swelling
- Hopping without pain, swelling or giving-way

### EXERCISE SUGGESTIONS

#### Strengthening

- Squats
- Leg press
- Hamstring curl
- Knee extension 90° to 0°
- Step-ups/down
- Lunges
- Shuttle
- Sports cord
- Wall squats

#### Neuromuscular Training

- Wobble board / rocker board / roller board
- Perturbation training
- Instrumented testing systems
- Varied surfaces

#### Cardiopulmonary

- Straight line running on treadmill or in a protected environment  
(NO cutting or pivoting)
- All other cardiopulmonary equipment

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#### CRITERIA FOR PROGRESSION TO PHASE 4

- Running without pain or swelling
- Hopping without pain or swelling (Bilateral and Unilateral)
- Neuromuscular and strength training exercises without difficulty

**PHASE 4: Advanced Training Phase** (Approximate timeframe: weeks 13 to 16)

#### GOALS

- Running patterns (Figure-8, pivot drills, etc.) at 75% speed without difficulty
- Jumping without difficulty
- Hop tests at 75% contralateral values (Cincinnati hop tests: single-leg hop for distance, triple-hop for distance, crossover hop for distance, 6-meter timed hop)

#### EXERCISE SUGGESTIONS

##### Aggressive Strengthening

- Squats
- Lunges
- Plyometrics

##### Agility Drills

- Shuffling
- Hopping
- Carioca
- Vertical jumps
- Running patterns at 50 to 75% speed (e.g. Figure-8)
- Initial sports specific drill patterns at 50 – 75% effort

##### Neuromuscular Training

- Wobble board / rocker board / roller board
- Perturbation training
- Instrumented testing systems

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- Varied surfaces

**Cardiopulmonary**

- Running
- Other cardiopulmonary exercises

**CRITERIA FOR PROGRESSION TO PHASE 5**

- Maximum vertical jump without pain or instability
- 75% of contralateral on hop tests
- Figure-8 run at 75% speed without difficulty
- IKDC Question # 10 (Global Rating of Knee Function) score of  $\geq 8$  (See page 9)

**PHASE 5: Return-to-Sport Phase** (Approximate timeframe: weeks 17 to 20)

**GOALS**

- 85% contralateral strength
- 85% contralateral on hop tests
- Sport specific training without pain, swelling or difficulty

**EXERCISE SUGGESTIONS**

**Aggressive Strengthening**

- Squats
- Lunges
- Plyometrics

**Sport Specific Activities**

- Interval training programs
- Running patterns in football
- Sprinting
- Change of direction
- Pivot and drive in basketball
- Kicking in soccer
- Spiking in volleyball
- Skill / biomechanical analysis with coaches and sports medicine team

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**RETURN-TO-SPORT EVALUATION RECOMMENDATIONS:**

- Hop tests (single-leg hop, triple hop, cross-over hop, 6 meter timed-hop)
- Isokinetic strength test (60°/second)
- Vertical jump
- Deceleration shuttle test
- MOON outcomes measure packet (mandatory; should be completed post-testing)

**RETURN-TO-SPORT CRITERIA:**

- No functional complaints
- Confidence when running, cutting, jumping at full speed
- 85% contralateral values on hop tests
- IKDC Question # 10 (Global Rating of Knee Function) of  $\geq 9$   
(See page 9)

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**IKDC Question #10**

How would you rate the function of your knee on a scale of 0 to 10 with 10 being normal, excellent function and 0 being the inability to perform any of your usual daily activities which may include sports?

CURRENT FUNCTION OF YOUR KNEE:

Cannot perform  
Daily activities

No Limitation

0 1 2 3 4 5 6 7 8 9 10

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## (2) Informed Consent

This Informed Consent has two parts:

- 1- Information sheet
- 2- Certificate of consent

**IMPORTANT:** You must send back the certificate of consent before the deadline of the enrollment if you want to participate in the study.  
You will receive a copy of the full document.

### 1- Information Sheet

#### **Introduction**

*I am Tamara Marin, a physiotherapist working for the Female Sports related Research Institute of Catalunya. Today we are working on the research of the Anterior Cruciate Ligament (ACL) injury, which is a joint located at the knee which is very frequently injured in sports in general, but seems to be more prevalent in females. Mentioning this, I want to give you a little more information to invite you to participate in this study. You do not have to decide today or right now if you want to be part of it, you can think about it, ask for second opinions, etc. It is also important to know that this participation is completely volunteer, which means you can drop at any part of the process. If there's some words or concepts that you don't understand, please feel free to ask me about it and I will clarify.*

#### **Purpose of the research**

ACL rupture is a very common and devastating injury in general, but mostly for active young people, like athletes. The literature shows that women are more likely than men to get this structure injured. That's why the purpose of this research will target female athletes to conclude whether the Surgical treatment or the Conservative treatment will provide to the patient a shorter and better return to sport and also to increase the chances of keep practicing in the long term.

#### **Participant Selection**

We are inviting female gymnastics between 14-19 years old that suffer an ACL rupture to undergo 2 different treatments to compare them.

#### **Voluntary Participation**

Participation for this project is entirely volunteer. The decision concerns you only, except for those people under age that will need parental approval as well. You have the right to not participate and you will not suffer any consequence, we will respect your choice.

In the case you decide to participate, it is very important that you commit yourself with the treatment for the sake of the study, it is important that you know that missing 2 sessions of the treatment will immediately take you out of this despite the point of the treatment.

Also, if you need to abandon the study for personal reasons or any other, you will always be able to drop, at any point.

In the case you decide not to participate and then change your mind, you can add yourself to the treatment as long as the allocation time is still open.

#### **Type of Research Intervention**

This research will use two different approaches to treat the injury. Both groups will share the Physical rehabilitation that will consist of 40 week treatment, from Monday to Friday, each session will take an hour and the patient will carry homework exercises for the weekends. After those 40 weeks, the session will be reduced to 3 times per week for 15 weeks in order to have a follow up and address anything that occurs in the meantime. One of the rehabilitation programs will include a Surgical intervention to repair the injury and then follow the Physical rehabilitation mentioned before.

## **Procedures and Protocol**

### ***A. Unfamiliar Procedures***

As we don't know which treatment is better for the outcomes that we want related to the ACL injury, we must compare them both. To do this, we will separate the participants in two groups, completely randomly located.

One group will undergo a surgery to repair the ligament and then will follow physical rehabilitation, the other group will follow only the physical treatment, this way we will be able to compare if the surgical intervention helps or not the patient to reach the outcomes.. We will collect this information and keep it until the treatment has finished, we do this to avoid the interference of our personal beliefs into the results.

You will be all along under the focus of our physiotherapist, if anything related to the treatment you can always come to them.

### ***B. Description of the Process***

The procedures will take place in a Sport Clinic located in Barcelona, you do not need to bring any extra material with you, just your DNI and sportive outfit.

An initial and at the end of the rehabilitation process an assessment will take place, to check the functionality of the knee, through the process assessment can be performed to adjust the therapy if needed. After 5 years you will be contacted to fill a survey asking if you're still practicing gymnastics at the same level.

### ***Duration of Treatment***

The treatment will last 24 months on average, you will be asked to assist 5 times per week to session for 90 minutes the first 40 weeks, then the session will be reduced at 3 times per week to keep a following up of returning to sport.

### ***Side Effects***

No side effects are expected. However, if you feel any discomfort of any type please let our team know about it as soon as possible.

### ***Risks***

There are also no risks expected because both interventions have clinical background, so, the risks are the same as expected in normal situations and are more related with the surgical intervention. (Rejection of the graft)

### ***Benefits***

You may not have any direct benefit applying for this study, but you will help us to answer your question and see which treatment has better results for our outcomes, which are specially thought for your population (athletes) so in an indirect way you will be helping young athletes in the future. Your injury will be healed in proper conditions and optimal circumstances, and any comorbidity or condition that appears during the treatment will be followed without any expenses from you.

### ***Reimbursements***

You will be reimbursed for the money you spend on transport, we will adjust the amount depending on how you mobilise (bus, train, car, etc). You will not receive any other reward to participate in this study.

### ***Confidentiality***

All the information shared with our team and collected for the study will be confidential. You will be assigned with a number for the data collection, which will be known only by the researchers and locked up with a key and only looked to assess the results.

The only information that will be shared is the one used to assess the results of the study

in order to publish it, and will not contain any private info.

**Sharing the Results**

All the data and knowledge that we accomplish after this study will be shared with you in a community meeting before it is available to the public. Confidential information as we mentioned before will not be shared. All the information published will be related with the outcomes of the treatment in order to spread knowledge and reach the people who's interested.

**Right to Refuse or Withdraw**

If you decide not to participate, you will receive the standard treatment and won't be affected in any way. If you decide to participate and then drop it, you also won't be affected in any way and the confidential benefit will remain the same.

**Who to Contact?**

If you have any questions related to the study and you need to contact someone, please feel free to contact me - Tamara Marin Rodriguez, 629724738, [tmarin.r6@gmail.com](mailto:tmarin.r6@gmail.com) - I'll be glad to help you.

**This proposal has been reviewed and approved by The Institute of Sports Research, which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find out more about the institute, contact Tamara Marin, [tmarin.r6@gmail.com](mailto:tmarin.r6@gmail.com) It has also been reviewed by the Ethics Review Committee of the World Health Organization (WHO), which is supporting/funding/sponsoring the study.**

**2- Informed Consent**

***have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions that I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this research.***

Full Name of Participant \_\_\_\_\_

Email \_\_\_\_\_

Date \_\_\_\_ / \_\_\_\_ / \_\_\_\_ /  
day month year

Signature \_\_\_\_\_

If Illiterate → I have witnessed the reading information to the potential participant, all questions have been answered, and the person wants to participate in the study voluntarily.

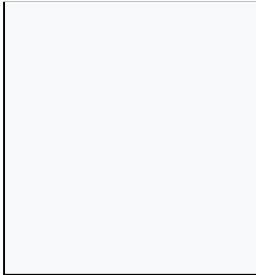
Full Name of the Witness \_\_\_\_\_

Email \_\_\_\_\_

Date \_\_\_\_ / \_\_\_\_ / \_\_\_\_ /  
day month year

Signature of the witness \_\_\_\_\_

Thumb print of the Participant:



**Statement by the researcher taking consent:**

I confirm that I have accurately read out the information sheet to the potential participant, and given the opportunity to solve any questions about the study, and all the questions asked by the participant have been answered with the maximum potential of my abilities. I confirm that the consent has been given freely and voluntarily and that the individual has not been coerced into giving consent.

**A copy of this ICF has been provided to the participant.**

Name of Researcher taking the consent: Tamara Marin

Signature of Researcher taking the consent \_\_\_\_\_

Date \_\_\_\_ / \_\_\_\_ / \_\_\_\_ /  
day month year



### (3) International Knee Documentation (IKDC) Questionnaire

#### 2000 IKDC SUBJECTIVE KNEE EVALUATION FORM

Name:   Date:   
First Last

Physician:  Date of Injury:

#### SYMPTOMS\*:

\*Grade symptoms at the highest activity level at which you think you could function without significant symptoms, even if you are not actually performing activities at this level.

1. What is the highest level of activity that you can perform without significant knee pain?

- Very strenuous activities like jumping or pivoting as in basketball or soccer
- Strenuous activities like heavy physical work, skiing or tennis
- Moderate activities like moderate physical work, running or jogging
- Light activities like walking, housework or yard work
- Unable to perform any of the above activities due to knee pain

2. During the past 4 weeks, or since your injury, how often have you had pain?

0 1 2 3 4 5 6 7 8 9 10  
Never             Constant

3. If you have pain, how severe is it?

0 1 2 3 4 5 6 7 8 9 10  
No pain            Worst pain imaginable

4. During the past 4 weeks, or since your injury, how stiff or swollen was your knee?

- Not at all
- Mildly
- Moderately
- Very
- Extremely

5. What is the highest level of activity you can perform without significant swelling in your knee?

- Very strenuous activities like jumping or pivoting as in basketball or soccer
- Strenuous activities like heavy physical work, skiing or tennis
- Moderate activities like moderate physical work, running or jogging
- Light activities like walking, housework or yard work
- Unable to perform any of the above activities due to knee swelling

6. During the past 4 weeks, or since your injury, did your knee lock or catch?

- Yes  No

7. What is the highest level of activity you can perform without significant giving way in your knee?

- Very strenuous activities like jumping or pivoting as in basketball or soccer
- Strenuous activities like heavy physical work, skiing or tennis
- Moderate activities like moderate physical work, running or jogging
- Light activities like walking, housework or yard work
- Unable to perform any of the above activities due to giving way of the knee

**SPORTS ACTIVITIES:**

8. What is the highest level of activity you can participate in on a regular basis?

- Very strenuous activities like jumping or pivoting as in basketball or soccer
- Strenuous activities like heavy physical work, skiing or tennis
- Moderate activities like moderate physical work, running or jogging
- Light activities like walking, housework or yard work
- Unable to perform any of the above activities due to knee

9. How does your knee affect your ability to:

		Not difficult at all	Minimally difficult	Moderately Difficult	Extremely difficult	Unable to do
a.	Go up stairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b.	Go down stairs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c.	Kneel on the front of your knee	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d.	Squat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e.	Sit with your knee bent	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f.	Rise from a chair	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g.	Run straight ahead	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h.	Jump and land on your involved leg	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i.	Stop and start quickly	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**FUNCTION:**

10. How would you rate the function of your knee on a scale of 0 to 10 with 10 being normal, excellent function and 0 being the inability to perform any of your usual daily activities which may include sports?

FUNCTION PRIOR TO YOUR KNEE INJURY:

Couldn't perform daily activities  0   
  1   
  2   
  3   
  4   
  5   
  6   
  7   
  8   
  9   
  10 No limitation in daily activities

CURRENT FUNCTION OF YOUR KNEE:


Cannot perform daily activities  0   
  1   
  2   
  3   
  4   
  5   
  6   
  7   
  8   
  9   
  10 No limitation in daily activities

IKDC Score

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## (4) Tegner Activity Scale and Anterior Cruciate Ligament Return to Sport After Injury (ACL - RSI)

		<b>ACL-RSI</b>									
NOMBRE						FECHA:					
Instrucciones: pon una marca en la línea, en la que mejor te describa en relación a lo que se describe											
<b>1. ¿Te sientes confiado de poder rendir a tu nivel previo de participación en el deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Para nada confiado											Completamente confiado
<b>2. ¿Piensas que es probable que te relesiones la rodilla al participar en tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Extremadamente probable											Para nada probable
<b>3. ¿Te sientes nervioso acerca de practicar tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Extremadamente nervioso											Para nada nervioso
<b>4. ¿Te sientes confiado de que la rodilla no fallará jugando a tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Para nada confiado											Completamente confiado
<b>5. ¿Te sientes confiado de que podrás jugar a tu deporte sin ninguna preocupación acerca de tu rodilla?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Para nada confiado											Completamente confiado
<b>6. ¿Encuentras frustrante tener que tomar en cuenta tu rodilla con respecto a tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Extremadamente frustrante											Para nada frustrante
<b>7. ¿Tienes miedo de relesionarte la rodilla practicando tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Miedo extremo											Ningún miedo
<b>8. ¿Te sientes confiado de que tu rodilla soportará bajo presión?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Para nada confiado											Completamente confiado
<b>9. ¿Tienes miedo de accidentalmente lesionar tu rodilla practicando tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Miedo extremo											Ningún miedo
<b>10. ¿Evitan pensamientos de tener que someterte a cirugía y rehabilitación el que opractiques tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Todo el tiempo											Nunca
<b>11. ¿Te sientes confiado sobre tu habilidad rendir bien en tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Para nada confiado											Completamente confiado
<b>12. ¿Te sientes relajado sobre jugar a tu deporte?</b>											
0	10	20	30	40	50	60	70	80	90	100	
Para nada relajado											Completamente relajado

ACL-RSI [Internet]. Knee Spain. [cited 2021 Dec 17]. Available from: <https://kneespain.es/escalas-y-cuestionarios/acl-rsi>

### **(5) Continuity in Gymnastics**

Identification of the patient \_\_\_\_\_

Are you still a gymnastic Yes \_\_\_\_ No \_\_\_\_

If the previous answer is No, is it related to the ACL injury suffered 5 years ago? Yes \_\_\_\_ No \_\_\_\_