Materiales docentes para el alumnado
Clases teóricas

UNIVERSIDAD DE MURCIA

Lesiones ligamentosas – Lesiones de rodilla (Parte 3)

Asignatura: Readaptación deportiva y reentrenamiento físico-deportivo

Docentes

D.ª Alba Aparicio Sarmiento	alba.aparicio@um.es
Dr. Francisco Javier Robles Palazón	franciscojavier.robles1@um.es
Dr. Francisco Ayala	francisco.ayala@um.es
Prof. Pilar Sainz de Baranda	psainzdebaranda@um.es

Facultad de Ciencias del Deporte
Universidad de Murcia - Campus de San Javier

PASOS A SEGUIR PARA LA READAPTACIÓN DE UNA LESIÓN DE RODILLA

1. ¿QUÉ? Conoce la anatomía y función de la estructura lesionada

LESIONES DE RODILLA MÁS COMUNES: Lesión del LCA en el deporte femenino

2. ¿CÓMO? Conoce cómo se ha producido la lesión al detalle para intentar entender las causas

3. ¿POR QUÉ? Estudia las posibles causas de la lesión para saber qué factores de riesgo abordar en la readaptación

MANOS A LA OBRA: Claves para la prevención de lesiones de rodilla

4. MANOS A LA OBRA: Periodiza la readaptación en fases y establece criterios de progresión en cada fase

5. TRABAJA EN EQUIPO: Mantén contacto con fisio, entrenador/a, psicólogo/a y con el/la deportista

MANOS A LA OBRA: Periodiza la readaptación en fases y establece criterios de progresión en cada fase

Deporte

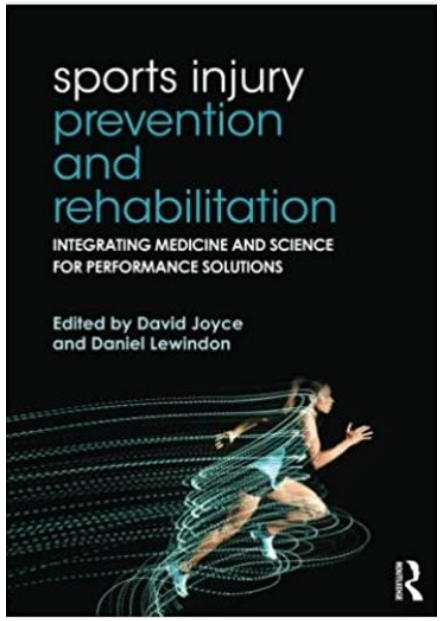
Unos seis meses después de la intervención quirúrgica con Ligamys se puede practicar sin restricciones un deporte suave que no cargue la rodilla (p. ej. montar en bicicleta, nadar, correr). Los deportes de contacto con cambios de dirección no se deben retomar hasta que hayan transcurrido como mínimo 9 meses y según el estado de rehabilitación del paciente.

Momento de la intervención quirúrgica

Como muy tarde 21 días después de la rotura

6. Phases of rehabilitation

1 Phase One: Protection and healing
2 Phase Two: Restoring muscle strength and range of movement
3 Phase Three: Integrated functional adaptation
4 Phase Four: Sports-specific retraining



We do not move between stages according to the passage of time, but the accomplishment of functional goals

6. Phases of rehabilitation

Table 24.2 The four phases of knee rehabilitation

Phase	*Focus*	*Key Objectives*
Phase 1	Protection and healing	Adequate healing Restore homeostasis
Phase 2	Motion and strength	Gross muscle mass and strength development Range of motion (ROM) restoration Propulsive and absorptive force development
Phase 3	Return to function	Functional patterns of movement Skill development relevant to the chosen sport Multidirectional speed and agility
Phase 4	Return to performance	Technical skill competence Competitive confidence Resilience Training load tolerance

6. Phases of rehabilitation: protection and healing

1 Phase One: Protection and healing

6. Phases of rehabilitation: protection and healing

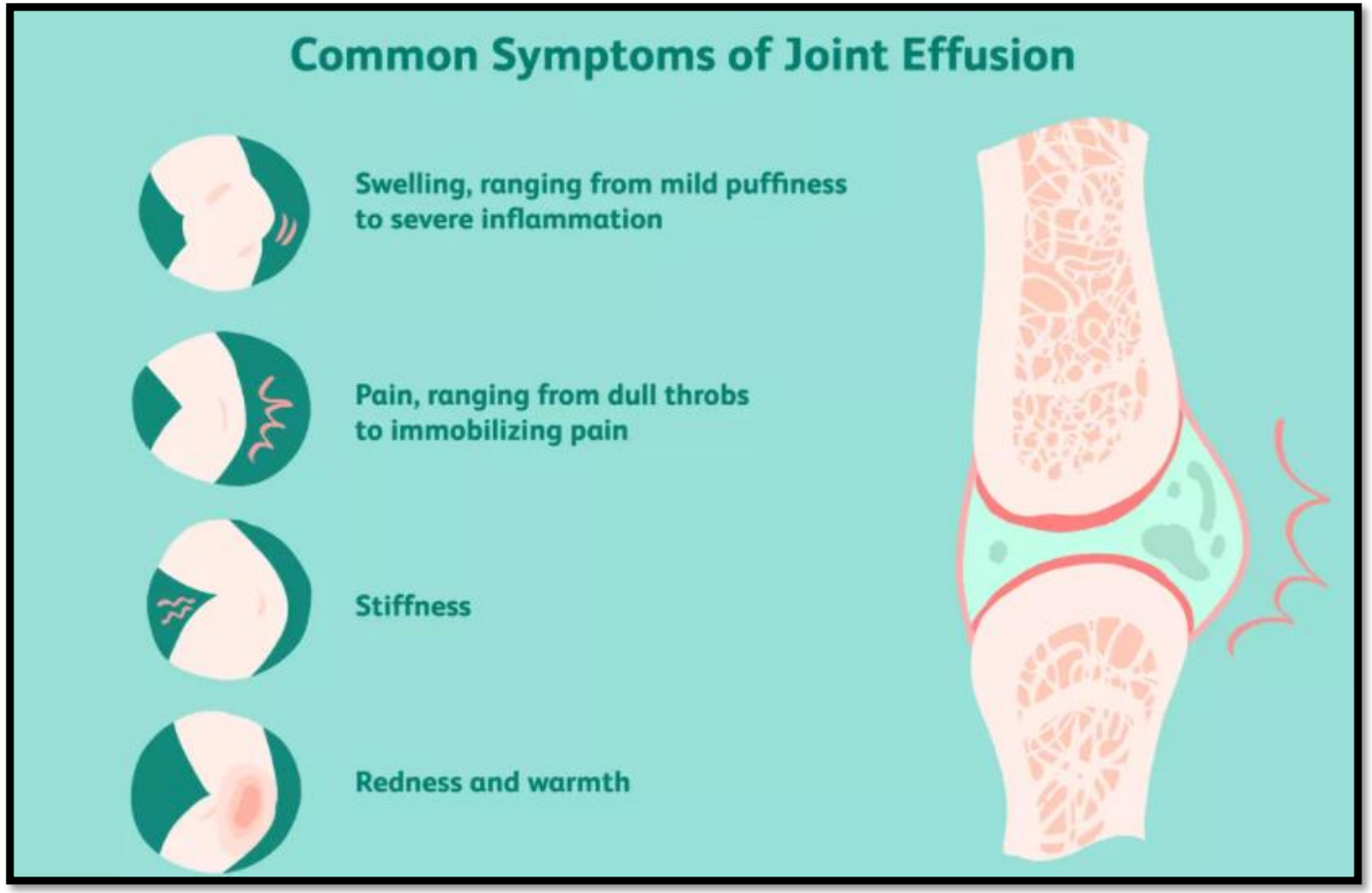
1 Phase One: Protection and healing

As soon as possible, however, we want to **restore normal gait mechanics**, as this has **positive effects on proprioception and muscle activation.** An effective way of graduating this is through an **altered weight-bearing environment, such as a pool.**

6. Phases of rehabilitation: protection and healing

The importance of removing effusions

A knee joint effusion is an excessive amount of fluid within the synovial capsule of the knee indicating that the knee is inflamed or irritated. The synovial membrane secretes synovial fluid and its secretion will increase in the presence of an intra-articular pathology



6. Phases of rehabilitation: protection and healing

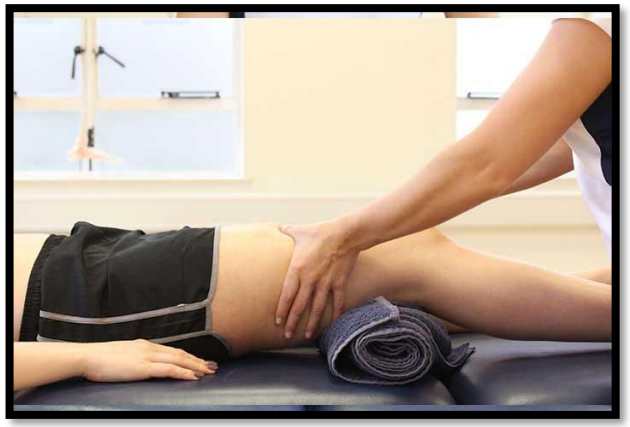
The importance of removing effusions

Effusion will detrimentally affect the function and outcome of the joint in a number of ways:

Increasing intra-articular joint pressure
Altering quadriceps muscle recruitment
Decreasing the stability mechanisms around the knee
Altering limb-loading patterns.

Removing the effusion does make a demonstrable difference to quadriceps function. This can be a frustratingly slow process, however, and so a number of interventions should be prioritised:

1 Regular assessment performed before loading the knee joint and in the subsequent 24 hours, particularly if the load is new and more progressive.
2 Remove the effusion, if present. This can be done with conventional methods, such as elevation, compression with donut felt, effusion massage and reduced weight bearing, or more medically directed interventions, such as non-steroidal anti-inflammatory medication (NSAIDs) or direct needle aspiration, if indicated. Removing the internal fluid will significantly reduce the internal pressure within the knee as well as improving quadriceps strength.
3 Exercise selection. Quadriceps setting exercises that are performed in positions of partial (20°) knee flexion or isometric squats in 20–30° flexion, will allow muscle recruitment without increasing the intra-articular pressure associated with full knee extension.
4 Early pool work provides us with the opportunity to take advantage of hydrostatic pressure to aid with effusion drainage.



6. Phases of rehabilitation: protection and healing

Reactivation of muscles in early phase rehabilitation

Since effective muscle function helps absorb joint loads, a restoration of contractile activity must be seen as a priority, and so in the early stages of knee rehabilitation the focus is on:

- quadriceps setting exercises
- quadriceps-hamstring co-contraction exercises
- isolated hip muscle exercises (particularly gluteals and hip external rotators) in a non-weight-bearing (lying down or sitting) or protected-weight-bearing situation (altered gravity treadmills or pools if available).

The return of quadriceps muscle bulk and thus strength is variable amongst different knee pathologies, and it is not uncommon to see ongoing differences in muscle bulk even after the athlete has returned to full competition. Often these muscle bulk differences will demonstrate equal side-to-side strength comparisons as the athlete returns to full function.

There are many ways to accelerate the return of muscle bulk and gross muscle strength in the early rehabilitation setting. Occlusion training and electrical muscle stimulation can be very helpful in gaining muscle hypertrophy in the early stages of rehabilitation where high mechanical and joint compressive loads are inappropriate.

https://www.youtube.com/watch?v=7TAslg8p2Vo

6. Phases of rehabilitation: protection and healing

Reactivation of muscles in early phase rehabilitation

- quadriceps setting exercises
- quadriceps-hamstring co-contraction exercises
- isolated hip muscle exercises (particularly gluteals and hip external rotators) in a non-weight-bearing (lying down or sitting) or protected-weight-bearing situation (altered gravity treadmills or pools if available).

6. Phases of rehabilitation: protection and healing

Reactivation of muscles in early phase rehabilitation

Since effective muscle function helps absorb joint loads, a restoration of contractile activity must be seen as a priority, and so in the early stages of knee rehabilitation the focus is on:

- quadriceps setting exercises
- quadriceps-hamstring co-contraction exercises
- isolated hip muscle exercises (particularly gluteals and hip external rotators) in a non-weight-bearing (lying down or sitting) or protected-weight-bearing situation (altered gravity treadmills or pools if available).

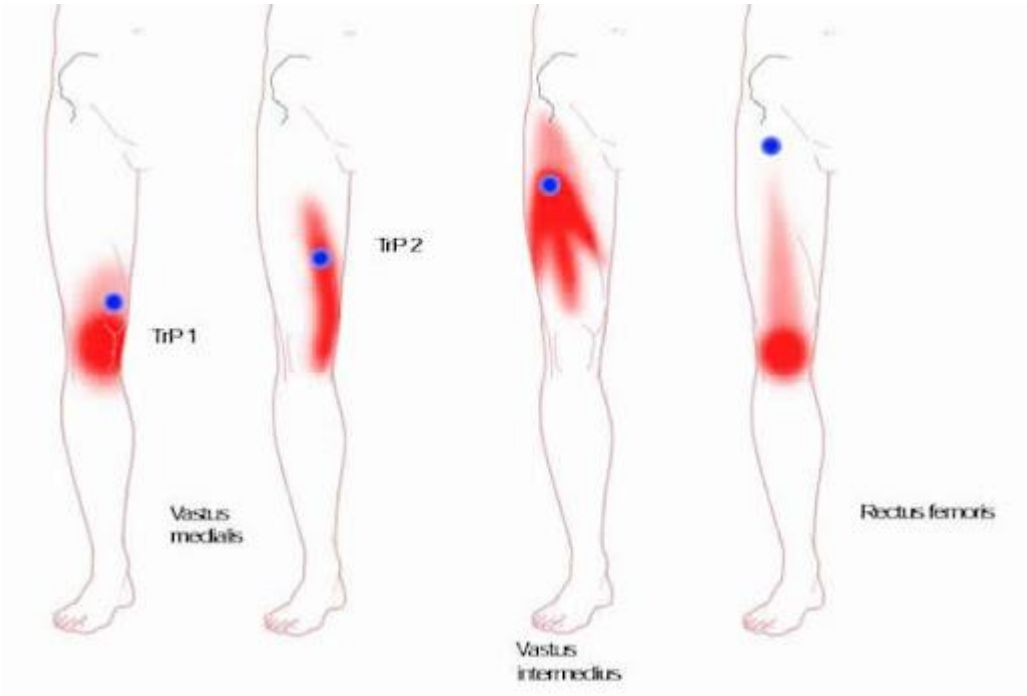
The return of quadriceps muscle bulk and thus strength is variable amongst different knee pathologies, and it is not uncommon to see ongoing differences in muscle bulk even after the athlete has returned to full competition. Often these muscle bulk differences will demonstrate equal side-to-side strength comparisons as the athlete returns to full function.

There are many ways to accelerate the return of muscle bulk and gross muscle strength in the early rehabilitation setting. Occlusion training and electrical muscle stimulation can be very helpful in gaining muscle hypertrophy in the early stages of rehabilitation where high mechanical and joint compressive loads are inappropriate.

6. Phases of rehabilitation: protection and healing

Restoring Range of Motion

Limitations in range of motion (ROM) are common following a knee injury, **particularly in terminal extension.** The primary mechanisms that limit the final 5–10° of extension can be broken down into **mechanical (intra-articular) and myogenic (muscle tone)** reasons. Dependent on the cause, manual therapy aimed at restoring accessory joint motion, effusion aspiration, soft-tissue massage, trigger-point releases and dry needling/acupuncture may help correct ROM restrictions.



6. Phases of rehabilitation: protection and healing

Criterios para progresar a la fase 2

To allow progression to phase 2 of rehabilitation, we suggest the following exit criteria are passed:

1 Resolution of active inflammatory process
2 Pain-free functional active knee ROM (may lack 5–10° of extension and 20° flexion)
3 Normalised pain-free walking gait
4 Good voluntary muscle action.

Sugerencia de lectura

Journal of Athletic Training 2021;56(10):1132–1136
doi: 10.4085/1062-6050-164-21

www.natajournals.org

Case Reports

Progressive Rehabilitation of a Professional Soccer Player After an Anterior Cruciate Ligament Reconstruction in Phase 1: Clinical Perspective with Video Demonstration

Francisco Javier Núñez Sánchez, PhD*; Francisco Ignacio Martínez Cabrera, PhD*; Fernando Hernandez Abad, PhD†; Luis Suarez-Arrones, PhD*

*Pablo Olavide University, Sevilla, Spain; †European University of the Canary Islands, Tenerife, Spain

Estudio de caso

Futbolista rumano de primera división que se rompió el cruzado en competición durante la temporada 2012-13. Volvió al mismo nivel de competición a los 7 meses y se ha mantenido compitiendo a ese nivel. Desde entonces, no ha vuelto a sufrir una lesión de rodilla hasta la actualidad (6 años después)

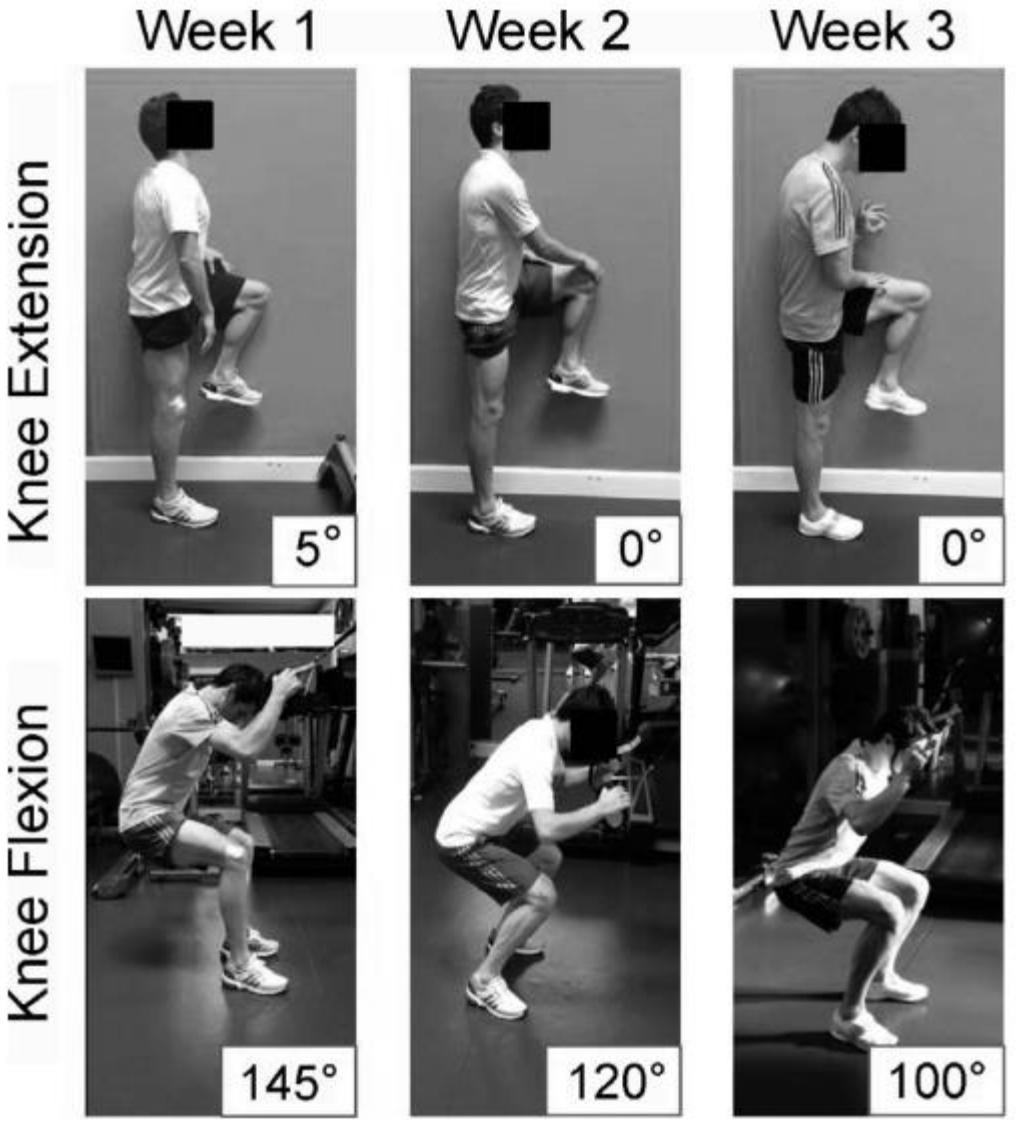


Figure 1. Improvement of knee extension-flexion angle week by week.

Estudio de caso

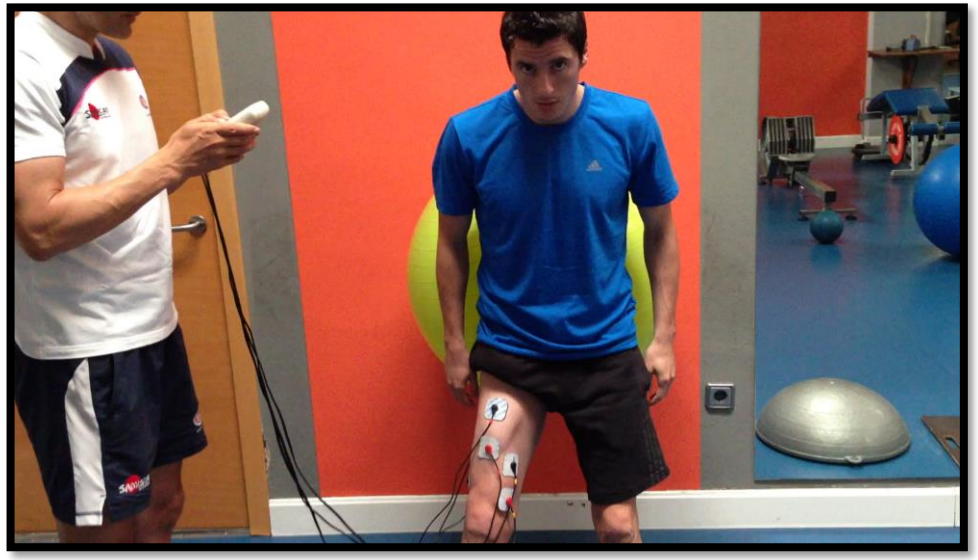
Progresión de ejercicios semana 1

Table 2. Postoperative Rehabilitation Week 1: Progression of Strength Exercises

	Sets or Reps by Day						
Exercises	1	2	3	4	5	6	7
Level of body functions and structures							
Seated active knee flexion-extension with heel slides + ESM	2 × 3.5-min ESM	2 × 3.5-min ESM	3 × 3.5-min ESM	3 × 3.5-min ESM	4 × 3.5-min ESM		
Horizontal closed kinetic chain with manual grips + ESM						2 × 3.5-min ESM	2 × 3.5-min ESM
Gluteal strength training	2 × 8 reps (–)		2 × 8 reps (–)		3 × 8 reps (–)		2 × 8 reps (+)
Adductor strength training		2 × 8 reps (–)		2 × 8 reps (–)		2 × 8 rep (+)	
Hamstrings strength training			1 × 8 reps (–)	1 × 8 reps (–)	1 × 8 reps (–)	2 × 8 reps (–)	
Level of activities and participation: displacement progression							
Anterior-posterior direction	2 × 4 reps (–)	2 × 4 reps (–)	1 × 4 reps (–)	1 × 4 reps (–)	2 × 4 reps (+)	2 × 4 reps (+)	2 × 4 reps (+)
Lateral direction			1 × 4 reps (–)	1 × 4 reps (–)	1 × 4 reps (–)	2 × 4 reps (+)	2 × 4 reps (+)
Diagonal direction			1 × 4 reps (–)	1 × 4 reps (–)	1 × 4 reps (–)	2 × 4 reps (+)	2 × 4 reps (+)

Abbreviations: (–), very low load or velocity of displacement; (+), low load or velocity of displacement; ESM, electrostimulation.

Estudio de caso



Estudio de caso

Estudio de caso

Progresión de ejercicios semana 2

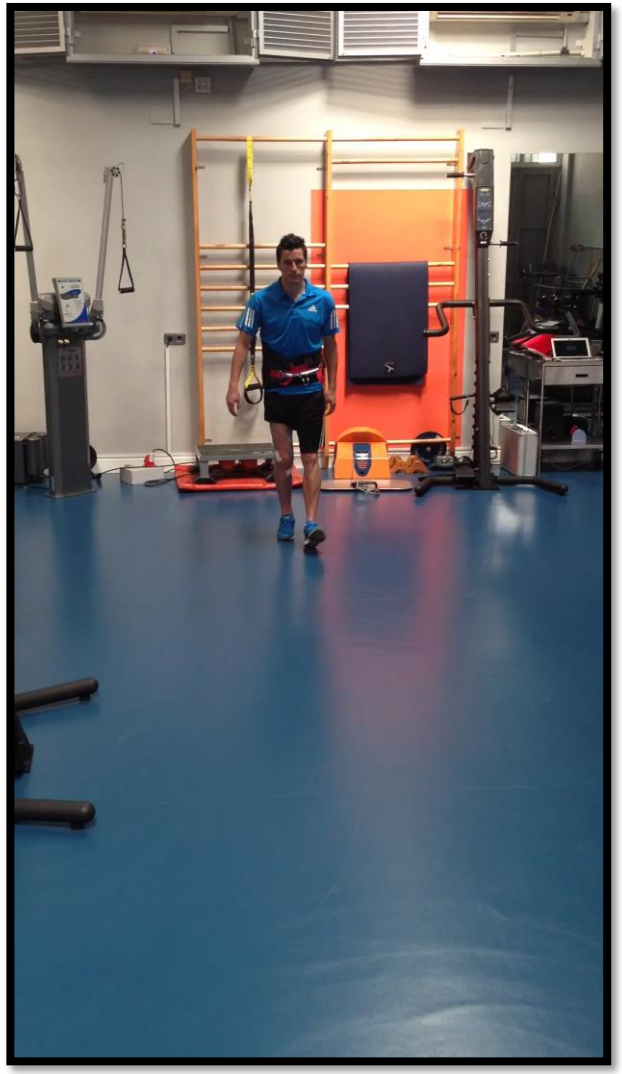
Table 3. Postoperative Rehabilitation Week 2: Progression of Strength Exercises

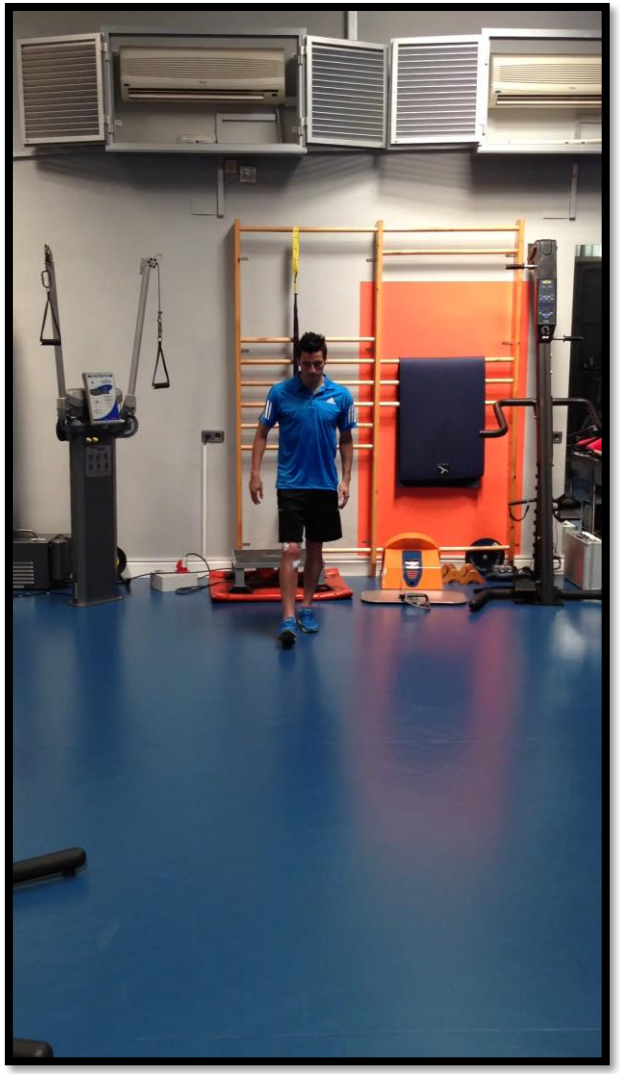
	Sets or Reps by Day						
Exercises	8	9	10	11	12	13	14
Level of body functions and structures							
Horizontal closed kinetic chain with manual grips + ESM	3 × 3.5-min ESM	3 × 3.5-min ESM	4 × 3.5-min ESM				
Vertical closed kinetic chain with a FitBALL on back + ESM				2 × 3.5-min ESM	2 × 3.5-min ESM	3 × 3.5-min ESM	3 × 3.5-min ESM
Gluteal strength training	3 × 8 reps (+)			3 × 8 reps (+)		3 × 8 reps (+)	
Adductor strength training	3 × 8 reps (+)			3 × 8 reps (+)		3 × 8 reps (+)	
Hamstrings strength training		3 × 8 reps (+)			3 × 8 reps (+)		3 × 8 reps (+)
Level of activities and participation: displacement progression							
Anterior-posterior direction	2 × 4 reps (+)		2 × 4 reps (+)		3 × 4 reps (++)		3 × 4 reps (++)
Lateral direction	2 × 4 reps (+)		2 × 4 reps (+)		3 × 4 reps (++)		3 × 4 reps (++)
Diagonal direction	2 × 4 reps (+)		2 × 4 reps (+)		3 × 4 reps (++)		3 × 4 reps (++)
Volitionally controlled center-of-mass movements in water in backward direction		6 × 4 reps (+)		6 × 4 reps (+)		9 × 4 reps (+)	

Abbreviations: (+), low load or velocity of displacement; (++), medium load or velocity of displacement; ESM, electrostimulation.

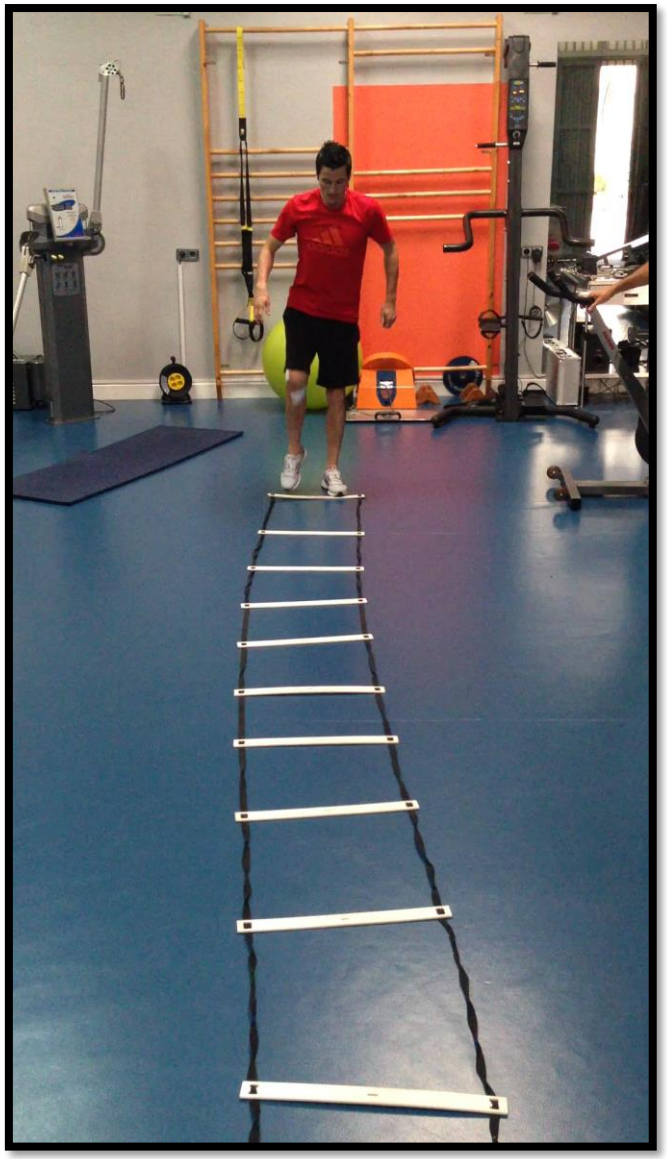
[a] Ball Dynamics.

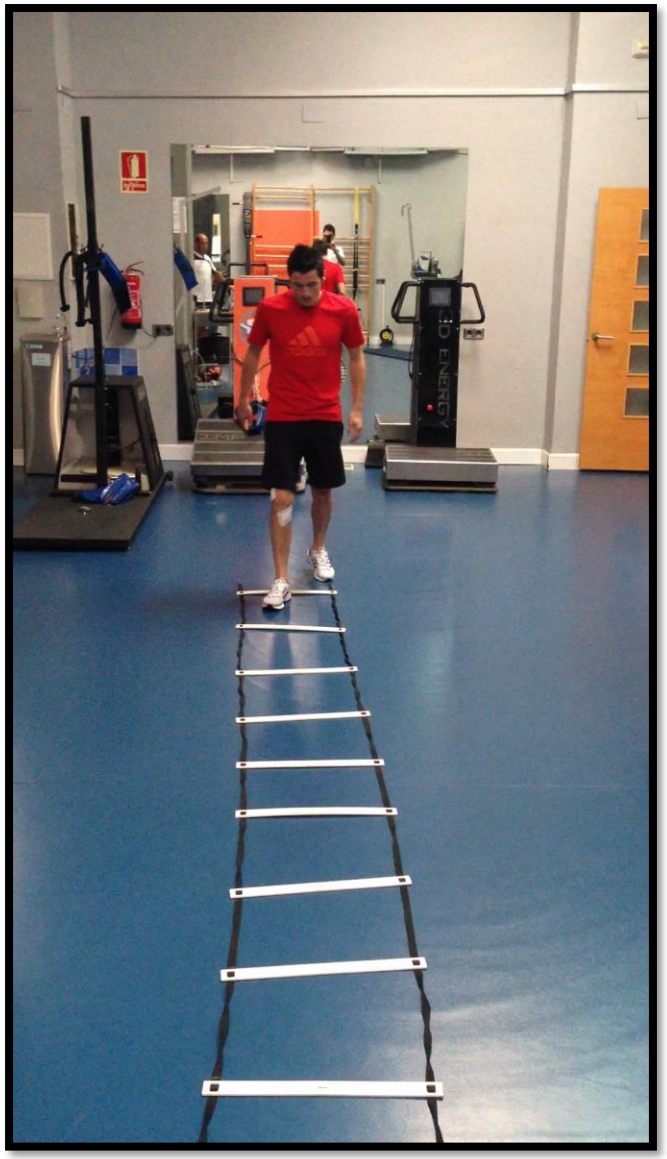
Estudio de caso



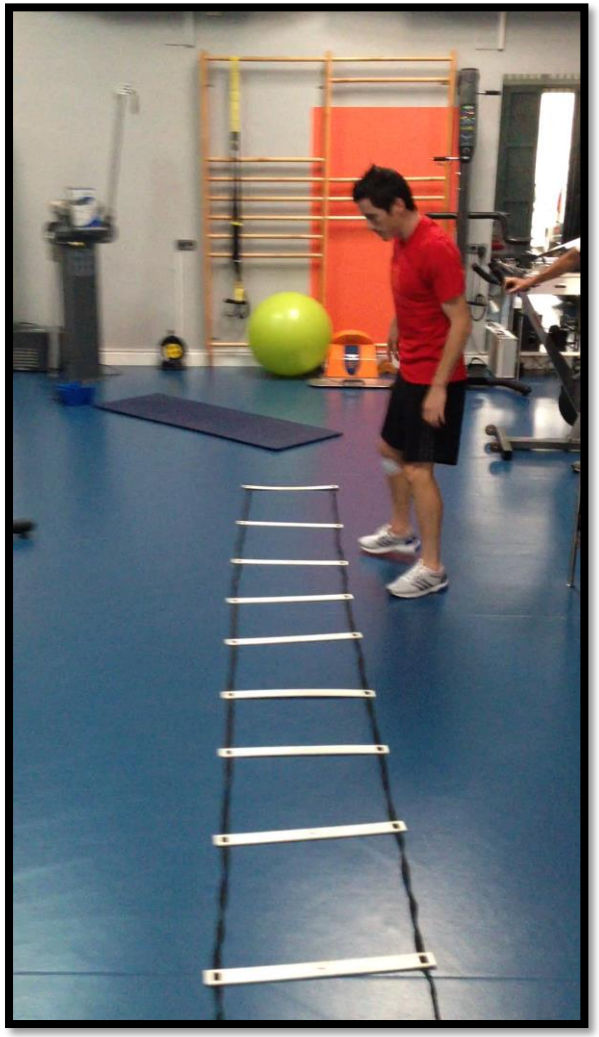


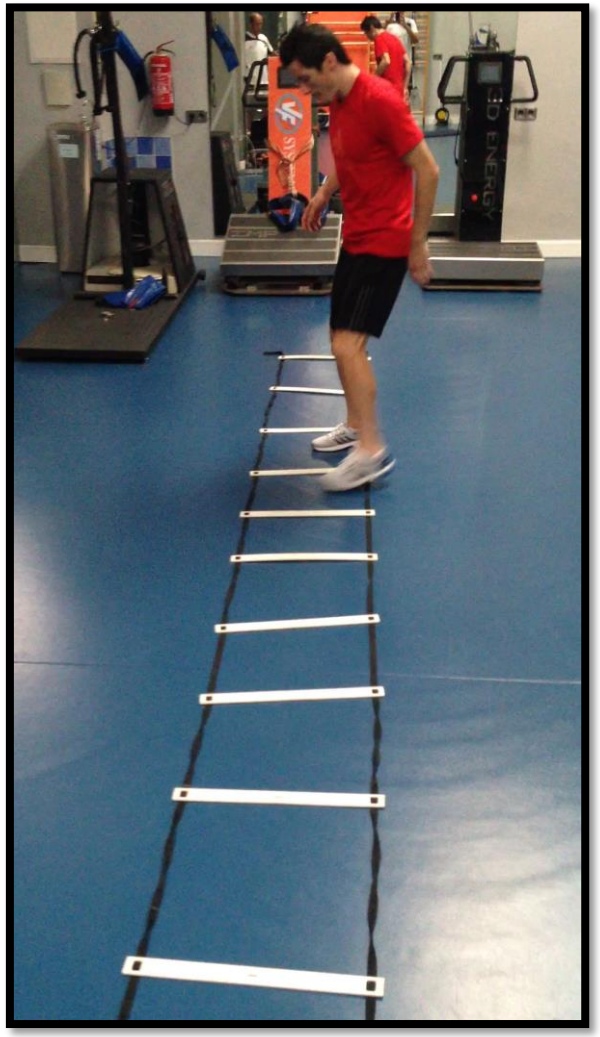
Estudio de caso

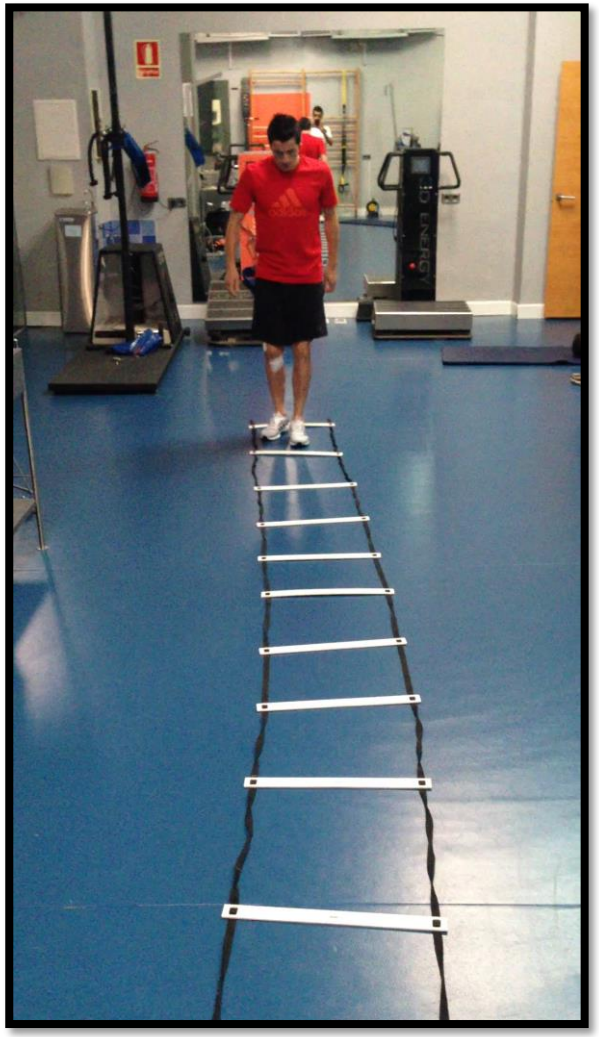




Estudio de caso







Estudio de caso

Progresión de ejercicios semana 3

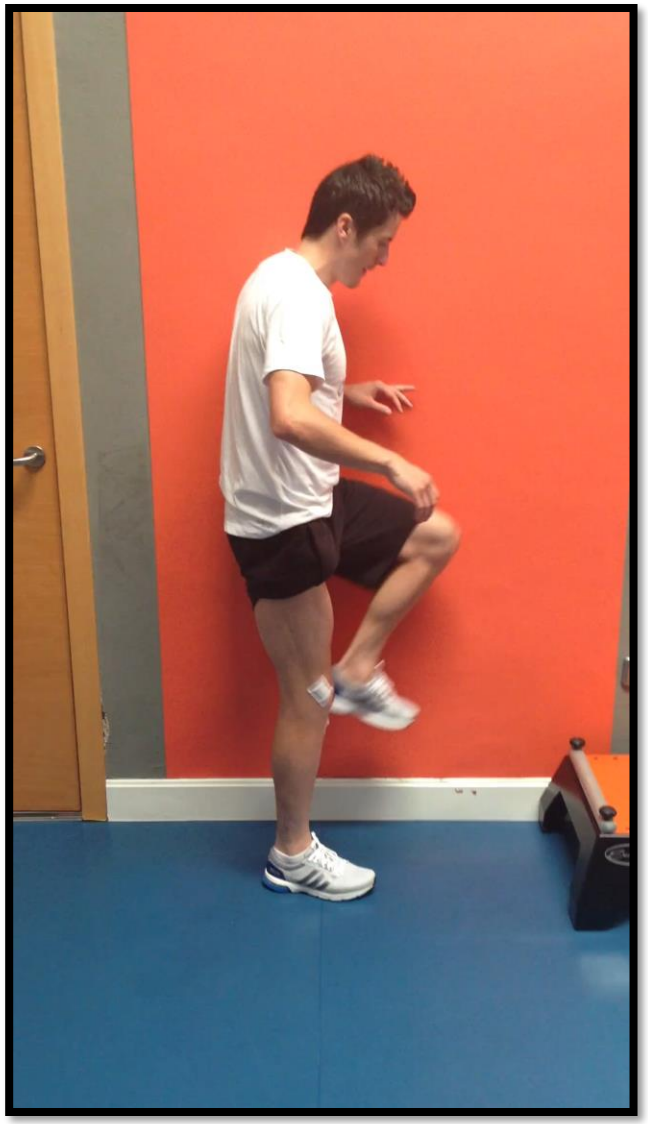
Table 4. Postoperative Rehabilitation During Week 3: Progression of Strength Exercises

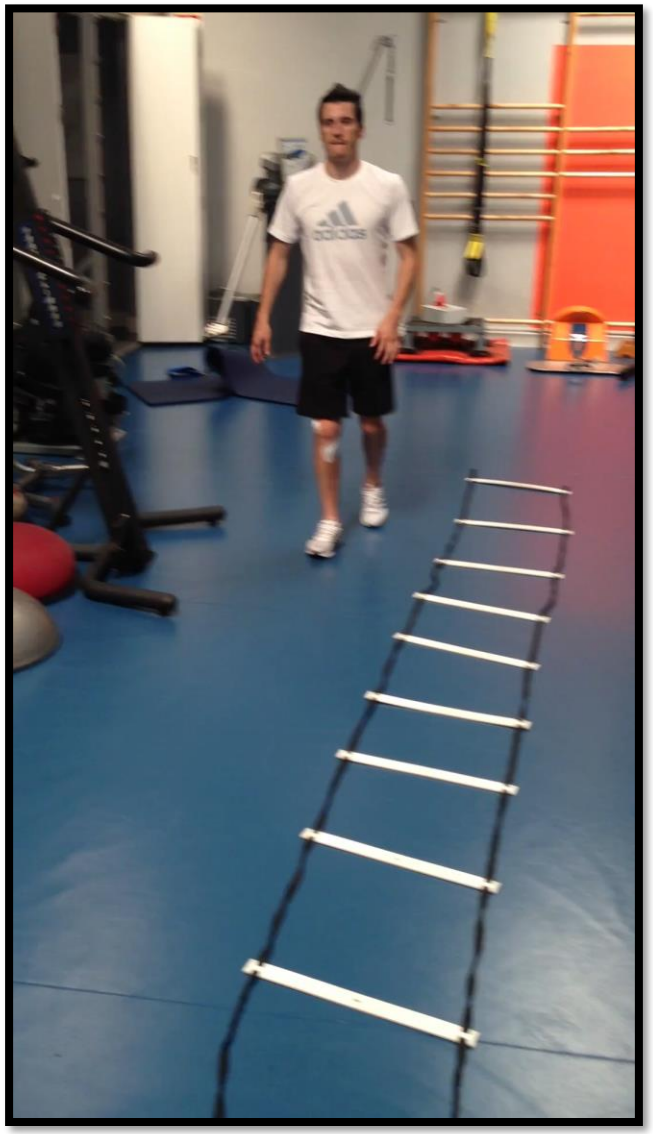
	Sets or Reps by Day						
Exercises	15	16	17	18	19	20	21
Level of body functions and structures							
Vertical closed kinetic chain with a fit-ball on back + ESM	4 × 3.5-min ESM	2 × 3.5-min ESM	4 × 3.5-min ESM	2 × 3.5-min ESM	4 × 3.5-min ESM	2 × 3.5-min ESM	4 × 3.5-min ESM
Gluteal strength training	3 × 8 reps (++)		3 × 10 reps (++)		3 × 10 reps (++)		3 × 10 reps (++)
Adductor strength training	3 × 8 reps (++)		3 × 10 reps (++)		3 × 10 reps (++)		3 × 10 reps (++)
Hamstrings strength training		3 × 8 reps (++)		3 × 10 reps (++)		3 × 10 reps (++)	
Calf strength training		2 × 8 reps (–)		2 × 8 reps (–)		2 × 8 reps (–)	
Level of activities and participation: displacement progression							
Anterior-posterior direction		4 × 4 reps (++)		4 × 4 reps (++)		4 × 4 reps (++)	
Lateral direction		4 × 4 reps (++)		4 × 4 reps (++)		4 × 4 reps (++)	
Diagonal direction		4 × 4 reps (++)		4 × 4 reps (++)		4 × 4 reps (++)	
Volitionally controlled center-of-mass movements in water in backward direction	9 × 4 reps (++)		12 × 4 reps (++)		12 × 4 reps (++)		12 × 4 reps (++)

Abbreviations: (–), very low load or velocity of displacement; (++), medium load or velocity of displacement; ESM, electrostimulation.

Estudio de caso

Estudio de caso





6. Phases of rehabilitation: motion and strength

The second phase of rehabilitation is geared towards the introduction of strength work. This can be broken down simply into knee-dominant and hip-dominant movements. These are essentially exercises done in a sagittal plane and involve the combination movements of ankle dorsiflexion/plantarflexion, knee flexion/extension and hip flexion/extension. In simple terms, examples of the following are:

1. Knee dominant: single-leg squat, single-leg lunge, leg press, Bulgarian (rear-foot-elevated) squat, Nordic hamstring curls
2. Hip dominant: Romanian deadlift, glute-ham raise, hip thruster.

The key feature in this stage is that the joints of the lower limb (knee joint included) are engaging in a coordinated manner that satisfies the kinetic chain requirements of the lower limb.

6. Phases of rehabilitation: motion and strength

Some rules/guidelines to follow when considering the implementation of these traditional clinical/gym-based movements are:

1. Propulsion/acceleration forces → The easiest and **safest to develop early**, involves concentric muscle force
2. Absorption/deceleration forces → This leads to the **greatest joint stress on the knee**
3. Temporal constraints → The emphasis on repetition **re-integrates the pathways between the peripheral and central nervous systems**, and provides a constant **proprioceptive-rich training environment** for the athlete that, by this stage, may have missed many months of training
4. Early plyometrics → Unloaded fast **eccentric exercises** and **pool plyometrics.**
5. Bilateral transfer → Early strength **work on the unaffected side** will assist in earlier functional recovery in the affected side

This strengthening phase needs to be appropriately periodised, involving fluctuations in volume and intensity, and may last for a few weeks or as long as four months following an ACL reconstruction.

6. Phases of rehabilitation: motion and strength

To allow progression to phase 3 of rehabilitation, we suggest the following exit criteria are passed:

1. Full resolution of any effusion
2. Full range of movement (may lack 10 per cent flexion)
3. Good control of single-leg squat
4. >70 per cent hamstring and quadriceps strength compared to contralateral side.

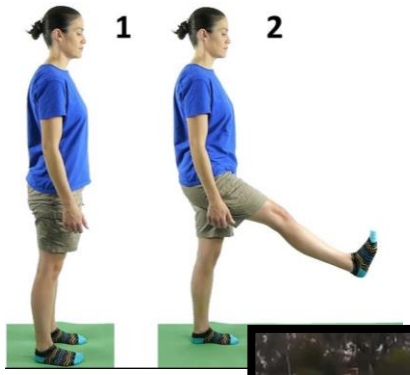
6. Phases of rehabilitation: return to function

The emphasis is now on sport-specific movements that need to be retrained prior to return to full training and subsequent competition.

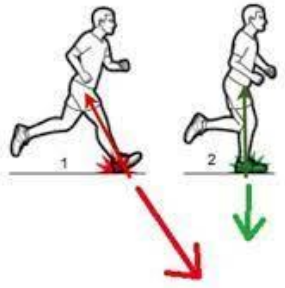
Return to running

6. Phases of rehabilitation: return to function

Criterion	*Aim*	*Drills*	*Coaching cues*	*Notes*
Speed and running mechanics	Incorporation of correct lower-limb to upper-limb movement sequencing	Triple flexion of the lower limb joints during swing phase (ankle dorsiflexion/ knee flexion/hip flexion) A drills	'Heel to butt'	The common tendency for injured athletes is to generate swing phase torque from pure hip flexion and not knee flexion.
	Increase force-absorption ability and impulse generation	B drills used to create train impulse generation upon foot strike	'Light on your feet'	Minimising ground contact time will encourage a more powerful impulse into the stance phase to push off
	Reduction of braking forces	Encourage the 'lift' under the buttocks to ensure the foot strikes under the hips and not in front. Running with a skipping rope	'Foot strike from above (not in front)'	If the athlete consciously thinks about foot strike, then they are more likely to over-stride during stance phase. By foot striking under the hips, braking force is eliminated and ground reaction force is reduced.

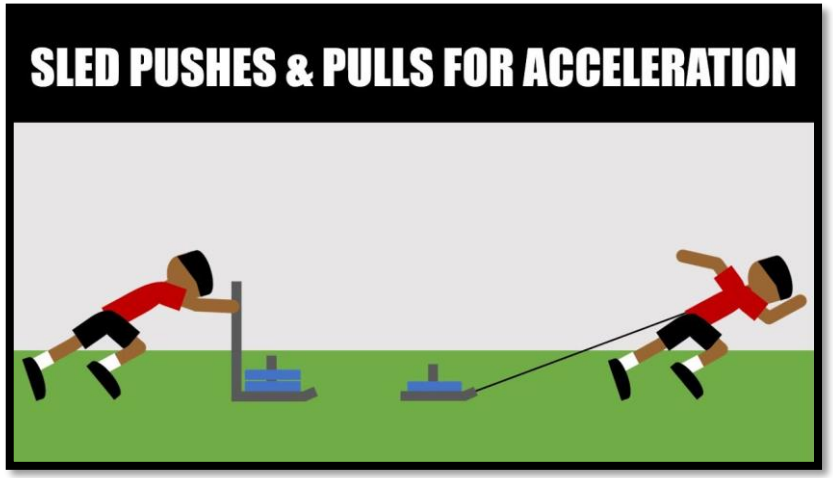


https://www.youtube.com/watch?v=5SQviRdHHRI



6. Phases of rehabilitation: return to function

Acceleration development	To functionally transfer the parallel gains in gross strength/power that is part of the reconditioning process	Short accelerations initially from rolling start and then from a stationary start	'Quick steps' The focus should be on the first 3–4 steps as being short, fast steps before building into a longer stride length.	Focusing on stride frequency rather than stride length will ensure the athlete can move their inertia into maximum velocity quicker.
	Arm drive into flexion/abduction to match the contralateral downward and backward force generated by knee and hip extension in acceleration	Simple wrist taping with a white tape will draw attention to the 'arm drive' being forward in front of the body and in the field of vision.	'Drive your arm forwards and up' 'Look for the tape in front of your eyes'	The legs push and drive backwards as the arm reaches and drives forward. This will ensure maximum acceleration.



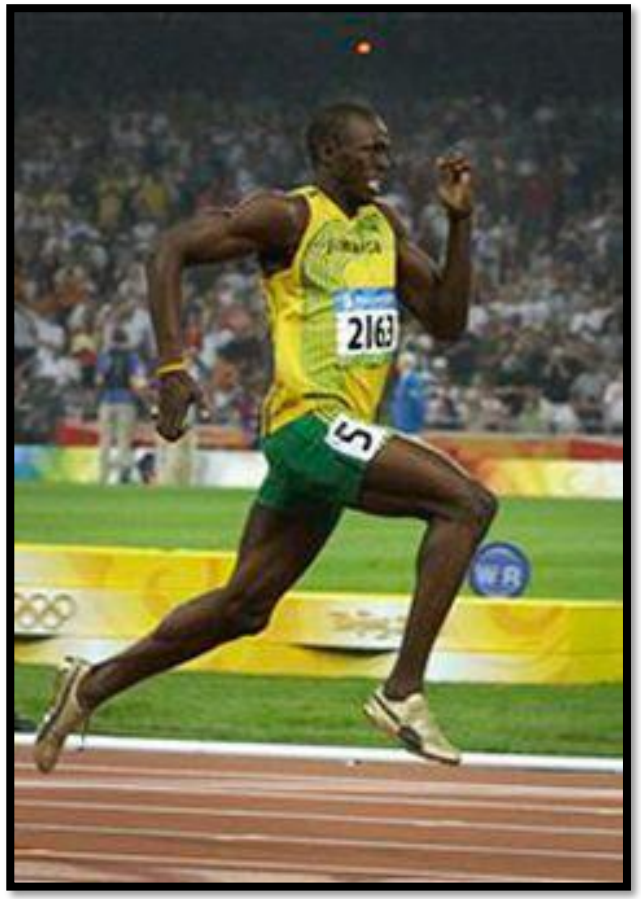
6. Phases of rehabilitation: return to function

Criterion	*Aim*	*Drills*	*Coaching cues*	*Notes*
	Symmetrical leg drive	Leaning triple extension drill – hands on a wall. From start position of one leg in triple flexion, aggressively drive leg into triple extension whilst bringing other into triple flexion.	'Equal force on each leg drive'	A common tendency for a post-knee-injured athlete is to de-power the injured side and to exaggerate the non-injured side.

https://www.youtube.com/watch?v=M4cJ9veVlF0

6. Phases of rehabilitation: return to function

Speed development	To expose the muscle and joint structures to the velocity of contractions and loading forces imposed by high-speed running	Sprint distances will initially need to be kept shorter than 50–60m until the athlete develops a level of speed endurance.	'Relax and lean'	Encourage the athlete to keep the shoulders slightly forward of the hips at high speed. This will discourage the common over-striding pattern that is evident in post-injured athletes.



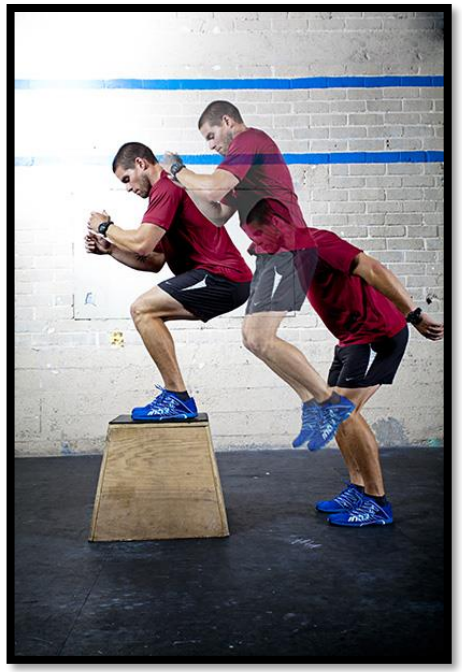
6. Phases of rehabilitation: return to function

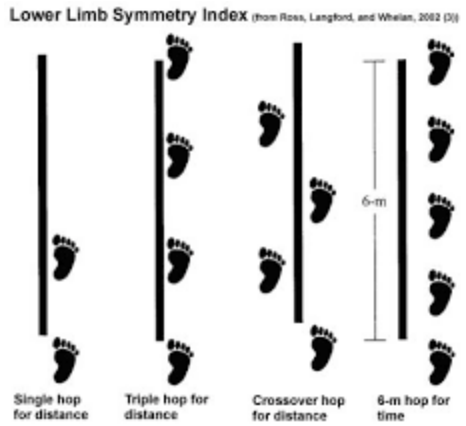
Criterion	*Aim*	*Drills*	*Coaching cues*	*Notes*
Deceleration capability development	Often the forgotten element in speed development. Once the athlete has been conditioned to run fast, they also need to be able to decelerate quickly.	Modify deceleration distance with objective marker (cones). Start with easy 20m deceleration distance and reduce to as little as 5m distance. Provide footwork challenges such as ladder drills following an acceleration.	'Shorten the steps' 'Drop the hips' 'Full foot plant'	The deceleration phase comes with the greatest risk of re-injury, as it causes the greatest joint stress.

https://www.youtube.com/watch?v=yNc310b6NZE

6. Phases of rehabilitation: return to function

Repeat box landings is helpful in training the ability to arrest body weight. These should be started by jumping onto a box and then progressed to jumping off. Start with double-leg landings and progress to single-leg and then vary the height of the box. The final progression should be jumping and landing for distance, where the athlete is forced to stabilise horizontal propulsion. This progression should take place over the course of a month.





6. Phases of rehabilitation: return to function

Table 4. Cutting development framework

	Phase 1	Phase 2	Phase 3
	Technique acquisition	Technique retention and integrity	Movement solutions
Aims	Introduce and teach different cutting techniques and reinforce and modify mechanics using closed, pre-planned drills of low intensity (low approach velocity and COD angle).	Cutting drills performed maximally, with increased intensity, to maintain and reinforce optimal mechanics under high mechanical loading.	Increased complexity and sports-specificity to provide random environment for athletes to retrieve, select, and perform the different cutting maneuvers. Performed under high cognitive load and constraints to improve decision making.
Intensity	Progressive increases in intensity via increases in approach velocity, angle, incorporating sports-specific implements, and stimuli. → Progressive increases in cognitive load via changes in skill practice and increased contextual interference.		
Example drills	Closed-, pre-planned drills, performed sub maximally 1. 20-45˚ XOC: 5-m entry and exit 2. 30-90˚ side-step: 5-m entry and exit 3. 30-90˚ split-step: 2.5-m entry and exit	Closed, pre-planned drills performed maximally. 1. 20-45˚ XOC: 5-10-m entry and exit 2. 30˚ XOC to 60˚ side-step: 5-m entry and exit between cuts 3. 30-90˚ split-step: 2.5-m entry and exit Increased complexity with the addition of several CODs and combinations of different cuts Introduction of sports-specific drills that incorporates an implement/object and open-drills performed sub maximally. 1. Y-agility drill past an opponent/response to ball 2. Mirror drill versus an opponent 3. Cut in response to a pass from a team mate	Evasive open-drills, and simulated sports-specific scenarios such as small sided games, conditioned games, etc. Example: Conditioned evasive SSGs i.e. pitch dimensions and rules 1. Touch rugby 3 vs 3 – limit number of passes to encourage evasive cutting actions 2. Y-agility drill past an opponent from various approach distances and environmental constraints Note: drills will be dependent on the task- and sporting-demands, and should be designed

Dos'Santos, Thomas, McBurnie y Comfort (2019): Biomechanical Comparison of Cutting Techniques: A Review AND Practical Applications

6. Phases of rehabilitation: return to function

To allow progression to phase 4 of rehabilitation, we suggest the following exit criteria are passed:

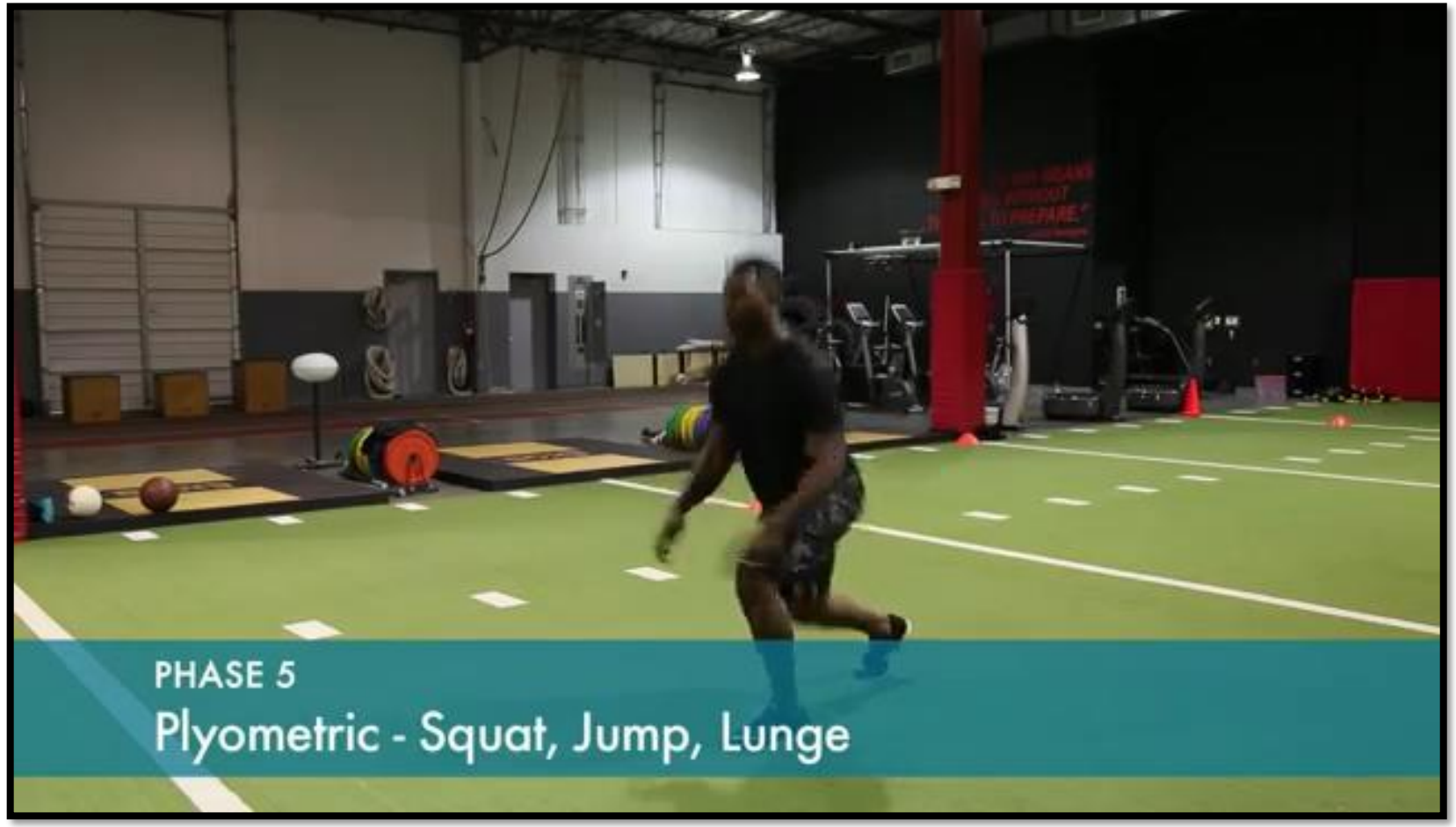
1. Maintenance of an effusion-free joint
2. Full range of movement (may lack 10 per cent flexion)
3. Good control of single-leg landing from a 40cm box
4. >85 per cent hamstring and quadriceps strength compared to contralateral side
5. Good control of 50° change of direction to either side
6. Return to >85 per cent of pre-injury maximum running speed

6. Phases of rehabilitation: return to performance

Sport-specific skill training

In this stage, high-level rehabilitation exercises that incorporate functional kinetic chain integration (ankle, knee, hip, pelvis, spine and upper limb) need to be implemented in a manner that challenges the athlete's proprioceptive abilities and reactive abilities. The purpose is conditioning the neuro-sensorimotor system to a wide spectrum on unpredictable stimuli so that infinite CNS connections are formed.

6. Phases of rehabilitation: return to performance

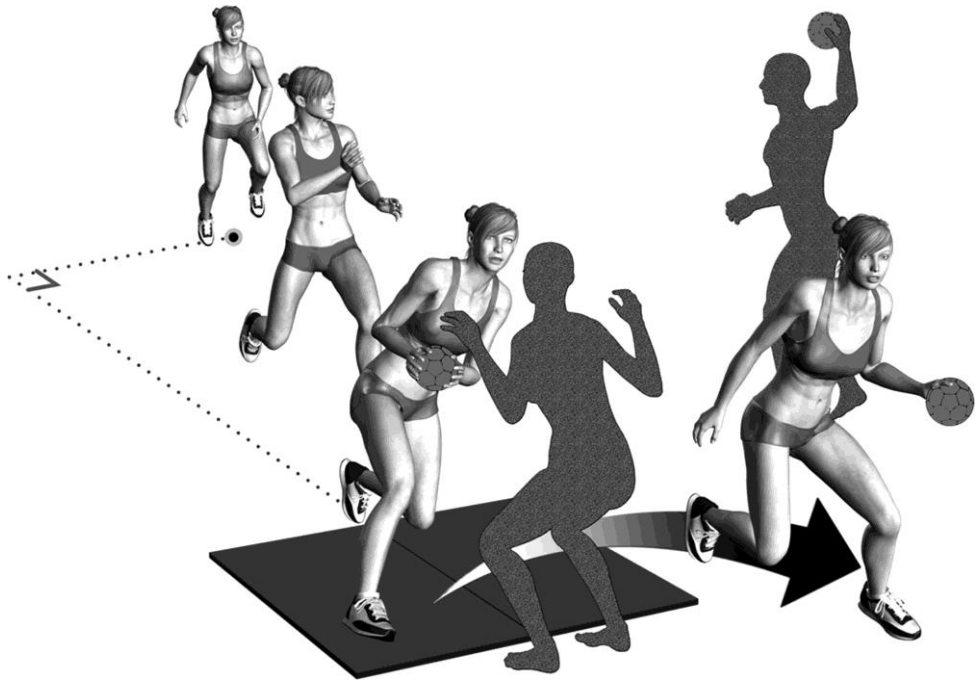


https://www.youtube.com/watch?v=zaFv0qNjSs0

6. Phases of rehabilitation: return to performance

The variables that can be manipulated to provide broad spectrum challenges are:

1 Surface. Stable (floor) to unstable (sand, balance boards, trampoline, mats).
2 Body movement. Stable on feet to unstable (rolls to stand, jump variations).
3 External load (cables, dumbbells, vests, asymmetrical weight barbell, kettle bells, suspension trainers, medicine balls).
4 Sensory cues. Variations in responding to sound, vision and touch.
5 Speed. Slow speed to fast movement.
6 Environmental obstacles. Other athletes, cones, hurdles, etc.



6. Phases of rehabilitation: return to performance

Sand-based training

https://www.youtube.com/watch?v=xsSzENWipSE

Due to the shifting surface, it provides a greater proprioceptive challenge, and furthermore, the sand absorbs much of the downward reaction force that is a positive benefit to the load compromised knee.

6. Phases of rehabilitation: return to performance

Trampoline drills

Full-size trampolines also provide a difficult balance environment for the knee-injured athlete.

6. Phases of rehabilitation: return to performance

Return to contact training

A logical way to prepare the athlete to develop match readiness is to modify the training environment from safe and controlled situations initially to more advanced game-specific events as they progress. For example starting in kneeling positions and then progressing to standing, walking and running positions allows the athlete to confidently practice contact components without fear of further knee injury.

6. Phases of rehabilitation: return to performance

Return to contact training

Table 24.4 Return to contact progressions

Stage	*Intensity*	*Posture*	*Aims*	*Content*
1	Low	Kneel	Simple contact/collision in knee-protected positions	1. Falling mechanics 2. Wrestling mechanics 3. Impact absorption 4. Forward hits 5. Fending
2	Low	Stand	Simple contact/collision in static stance	As above but at a slightly increased velocity
3	Low	Walk	Simple contact/collision in safe and controlled walking situations	1. As above but, again, at a slightly increased velocity 2. Hit and spinning
4	Medium	Walk-jog	Progressions to game simulation in walking	1. Down + ups 2. Specific wrestling 3. Being tackled/hit in varying scenarios (high-low) 4. Double combined efforts 5. Footwork (attack + defence)
5	Medium	Jog	Increase impact forces	As above but at a slightly increased velocity
6	Medium	Run	Increase impact forces	As above but at increasing velocities
7	High	Run	Match situations	Combination of different areas of contact and running
8	High	Sprint		Position Specific
9	High	Maximum		Position Specific

6. Phases of rehabilitation: return to performance

To allow progression to full competition, we suggest the following exit criteria are passed:

1 >90 per cent of pre-injury hop distance and cross-over hop test results
2 Return to full sprint speed
3 Return to full acceleration and deceleration velocities
4 Full competence and confidence over the course of a prolonged period of competitive training (as reported by the coaching and support teams, as well as the athlete themselves).
4 >90 per cent hamstring and quadriceps strength compared to contralateral side

Ya estamos compitiendo

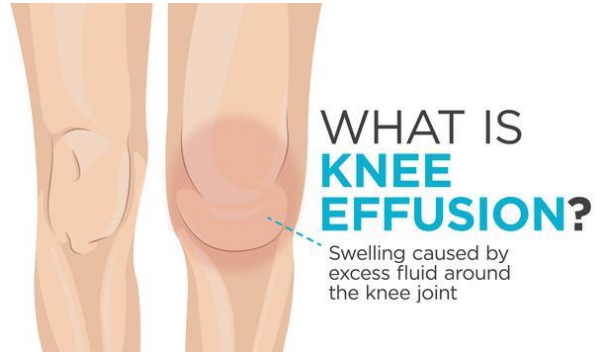
1 Regular assessment of effusion, particularly after a major change has been implemented, such as a new skill, extra load, plyometric-type training, frequent exposure to competition/training.

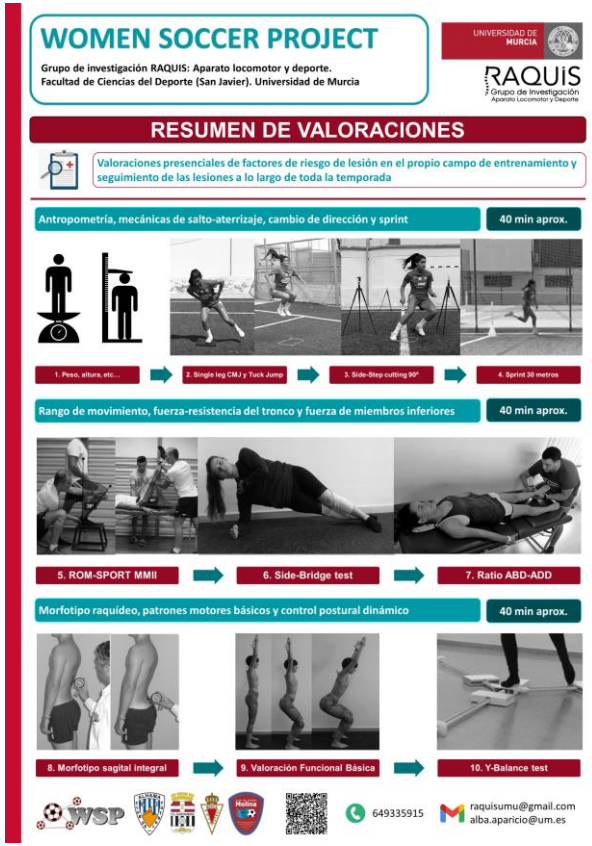
2 Regular assessment of functional tests to ensure the athlete stays within acceptable levels.

3 Load monitoring. This can be direct volume and impact monitoring using GPS or, if unavailable, carefully selecting the training sessions the athlete will be involved in. They may need to miss the occasional session to allow knee joint recovery.

4 Regular soft tissue therapy to ensure the myogenic elements are not reacting adversely to load.

5 Education of both athlete and coaches. All interested parties need to be aware that the knee may require periods of de-loading to restore a healthy homeostasis.





TRABAJA EN EQUIPO:
Mantén contacto con el/la fisio, el/la entrenador/a, el/la psicólogo/a y con el/la deportista

TRABAJO INTERDISCIPLINAR EN TODO EL PROCESO

FISIOTERAPEUTA

ENTRENADOR/A

READAPTADOR/A

PSICÓLOGO/A