PATELLOFEMORAL PAIN SYNDROME:
INFORMATION & REHABILITATION PROTOCOL

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The Knee

The knee is a large complex joint that allows for movement between the thigh bone (femur) and shin bone (tibia). It is comprised of tendons that attach to thigh muscle for movement, menisci for stability and shock absorption, and ligaments that provide added stability. The areas of bone that glide against one another are covered by smooth resilient articular cartilage and are referred to as articular surfaces. In the knee articulation happens in two places: between the patella and femur (patellofemoral), and the tibia and femur (tibiafemoral).

What is Patellofemoral Pain Syndrome (PFPS)?

Patellofemoral pain is a term used to describe pain under the knee cap (patella) and its exact cause can vary between individuals. Some common symptoms may also include scratching, grinding, or a clicking sensation in the knee. The pain, due to an inflammation of the articular surface, can potentially be caused by poor tracking of the patella over the femur during
movement. Several factors can contribute to this, although one common reason is a weakness or imbalance between the muscles on the front of thigh (quadriceps). There are four muscles that converge into the quadriceps tendon and attach to your knee cap. They primarily work to straighten the knee. If one muscle is weaker than another muscle, it affects the direction the patella is pulled. Weakness at both the hip and foot can also play a role in PFPS.

Some common contributing factors to PFPS:

- Weak thigh and/or hip muscles
- Tight muscles – Poor flexibility
- Poor footwear
- Sudden increase or change in physical activity
- Being overweight
Simple steps to help ease an acute episode of pain:

DO:

- Apply an ice pack to your knee for up to 15 minutes, 4 times per day. This can relieve pain as well as reduce swelling.
- Gentle knee movements that do not aggravate symptoms or cause pain.
- Wear supportive footwear – even around the house!
- Take non-steroidal anti-inflammatory drugs (NSAIDs), like ibuprofen. Discuss this with your pharmacist or doctor.

DO NOT:

- Go on bed rest, limp in fear of pain, or avoid using knee as you would in normal daily activity.
What will help me with my pain?

Stretching and Resistance Training

Please see Rehabilitation Programme section for details.

Cardiovascular Training

Cardiovascular training increases blood flow and nutrients to structures which enhances healing and can decrease tightness and stiffness in the muscles and joints. Research has shown that exercise increases production of endorphins- the body’s natural pain killers which can help with pain. Endorphins can also elevate mood and help you to stay active.

In early stages of rehabilitation, it is important to select cardiovascular exercises that are low impact to avoid high forces through the knee joint. It is important to do them regularly and consistently for the most benefit.

Walking

Walking is a low level exercise unlikely to overload the knees and is associated with a low injury rate. Moreover, walking doesn’t require any equipment and can be done anywhere, inside or outside.
Cross Trainer and Cycling

Both are excellent options for cardiovascular training, although cycling should be left until the later stages of rehabilitation due to the nature of forces going through the knee. These exercises are considered low impact, meaning your joints do not have to absorb much force from the ground while you strengthen your legs. When progressing to incorporating cycling into the rehabilitation programme it is very important the seat height is set appropriately. There are several quick ways to do so, one such method is: with the seat in your armpit and outstretched arm, you should just be reaching the centre of the chain ring with your longest finger. For safety, be sure not to move the pedals while doing so.

Good Nutrition and Lifestyle

Consistently good nutrition optimised for training and recovery can make a significant difference to any resistance programme. One can think of building muscle as laying a foundation of bricks for a new house. Let’s just say that with every training stimulus, your body can lay 100 bricks a day under perfect conditions. If your nutrition is poor
your body may only be able to lay 10 bricks as it does not have the necessary tools. The most important “tool” that is most commonly missing in people’s diets is adequate protein intake. The amino acids that protein is comprised of are the building blocks for new muscle. Without it you can say your body has no bricks to lay even when bricklayers are available. Current evidence shows that optimal protein intake for those undertaking a resistance training programme is 1.6 grams(g) per kilogram(kg) of bodyweight every day and spaced out evenly every 3-4 hours. Good sources of protein include lean beef, poultry, fish, dairy, eggs, and legumes – be sure to include them in your diet.

A few other simple lifestyle changes can be made to enhance recovery. Sleep is often overlooked but plays an important role in healing. Ideally, we should be getting at least 8 hours every night. Both smoking and alcohol put undue stress on the body, delay recovery, and should therefore be avoided.
Rehabilitation Programme

If you are performing any exercises for the first time make sure the therapist is there to guide you.

**STOP** these exercises immediately if they flare up your symptoms (not normal work out pain) and pain persists after ceasing movement, or causes swelling around the knee. Ice your knee and inform your physiotherapist. This applies to all phases of this rehabilitation programme.

**Stage 1**

**Aqua Jogging**

*To be performed a minimum of 3 times a week.*

Before beginning, be sure to secure a flotation belt around your waist as these exercises should be done in sufficiently deep water you cannot touch the bottom.

Start with walking and progress to running (not swimming) in the pool for 4 laps followed by 3 stretches: quadriceps, hamstring, and calf as discussed below. Repeat this fours times.

If you do not have access to a pool you can replace aqua jogging with normal walking.
**Stretching**

Stretching keeps your muscles from getting tight which allows you to maintain good natural movement. This can also reduce the passive tension of your muscles on the joint and may help alleviate symptoms. Stretching 2 - 3 times a day helps increase mobility and can decrease pain.

If you have access to a pool, follow the stretching programme below. The goal of therapy for those with patellofemoral pain is to build muscle strength and increase flexibility. When the thigh muscles are strengthened and in balance, they stabilise the knee cap to provide optimal gliding of the patella over the thigh bone and ultimately improve everyday movements.

**Stretches:**

*To be performed a minimum of 5 days a week, twice daily. Try and schedule a rest day after 2-3 consecutive training days.*

**Stretch 1: Quadriceps**

Stand on one leg and bend opposite leg until you can grab ankle behind thigh. By pulling foot close to back of thigh and pulling knee back you will feel a stretch at the front of your thigh. **Hold this position for 30 seconds.**
**Stretch 2: Hamstring**

Place foot of leg onto elevated surface with a straight knee. To begin stretch reach towards foot of elevated leg with back straight until you feel tightness at the back of thigh and cannot reach any further. Hold this position for 30 seconds.

**Stretch 3: Calves**

Stand on a step with one heel hanging off the edge. To begin the stretch, with a straight knee, let your heel drop down off the step until it cannot go any further. Hold this position for 30 seconds.
Exercises:

To be done until you can no longer perform a perfect, controlled repetition and the muscle is tired. The progression of all these exercises is the same motion with added resistance band (as pictured).

Exercise 1: Straight Leg Raise (SLR) standard

Start in a lying position. Before you begin the movement, tighten your thigh muscles and straighten your leg. Lift your leg up straight towards the sky about 1 foot off the ground, then gently lower it in a controlled manner.

Exercise 2: SLR with externally rotated hip

Start in a lying position with your foot rotated ~45 degrees out the way. Before you begin the movement tighten your thigh muscle and straighten your leg. Lift your leg up straight towards the sky about 1 foot of the ground, then gently lower it in a controlled manner.
**Exercise 3: Knee extension**

Start by placing something under your knee to give a few degrees of bend – this can be anything from a foam roller to 2-3 rolled-up towels. While using this as a fulcrum on which to rest your leg, tighten your thigh muscles and straighten the knee. Hold this position and squeeze your leg muscles for 3 seconds and slowly lower your leg to return position. Repeat until tired.

**Cardiovascular work: Cross trainer**

Use the cross trainer or bike for 15 minutes, beginning at a low resistance and progress to a higher resistance as able. This should be as challenging as possible without bringing on any symptoms.
Core exercises

Once you can hold each exercise comfortably for more than a minute move onto the next phase.

1. Bridge

Initial position:

Lie on your back with your knees bent
Flatten the top half of your back into the ground and lift your hips up by pushing through your heels

Focus on keeping a straight alignment.

To the right you can see the two further levels of progression – single leg bridge and single leg with theraband.
2. Plank

Initial position:
Start on your knees and forearms
Straighten out your legs to take the weight through forearms and feet.
Focus on tightening your core muscles to keep your back straight
To the right you can see the two further levels of progression – single leg plank and single leg with theraband.
3. Side Plank

Start side lying with legs straight

Place your elbow directly under your shoulder to prop up your torso

Focus on keeping your body in a straight alignment – hips forward and avoid rotating top shoulder forward

To the right you can see the two further levels of progression – single leg side plank and single leg with theraband.
Stage 2

Resistance Training

Strengthening and stretching exercise for thigh muscles, particularly quadriceps, play a crucial role in treating the underlying cause of patellofemoral pain. The exercises should be at least moderately challenging to get the full benefit of the programme. It is important to keep in mind the goal is to build muscle just as with any resistance programme. The difference here is the exercise type and parameters are specifically tailored to your stage of recovery. The FITT principles can and should be applied to rehabilitation. These are the most important aspects of an exercise programme as they add up to create the appropriate stimulus the body needs to build muscle. Consistency is key is creating the optimal conditions for growth.

FITT Principles:

Frequency – enough to induce a physiological adaptation, often 5 days a week.

Intensity – moderate intensity exercise. Aim for between 10-15 repetitions. If you can do more they are not challenging enough.

Time – long enough to properly stress the muscles, this is also dependant on intensity.

Type – must be specific to what you are trying to achieve or target the musculature you are trying to develop.
Exercise 1: Leg press

Feet shoulder with apart with toes pointed slightly outwards. Knees should track over 2nd toe throughout the movement. Bottom position should be with knees bent at least 90 degrees. Avoid hyperextending knees at top of movement. Take 3 seconds to move from top to bottom position.

Exercise 2: Hamstring curl

Start with both legs straight. To perform movement: Pull heels back and down towards buttock until at least a 90-degree knee bend has been reached. Hold for 1 second, then allow for 3 seconds to return to starting position.
Stage 3 – ADVANCED: Return to sport only

CAUTION – THIS STAGE IS NOT FOR EVERYONE! DO NOT BEGIN THIS STAGE OF THE PROGRAMME WITHOUT FIRST CONSULTING YOUR PHYSIOTHERAPIST OR A MEDICAL PROFESIONAL.

Exercise 1: Step up

To begin, choose a small box or step about the height of a standard step on a staircase. Without using the other leg for assistance, use the leg on the step to bring yourself up. Gently lower yourself to the start position - you should have complete control throughout this movement and be able to hover your other leg over the ground if asked to. Make sure your knee is always tracking over your 2nd toe throughout the movement. To progress this exercise, you can either hold dumbbells or find a higher step.
Exercise 2: Barbell Squats

Choose a symmetrical grip of the bar sufficiently wide enough to comfortably get under, yet narrow enough to retract your shoulder blades and contract your upper back muscles. This is important so the bar is meant to rest on your upper trapezius muscle rather than spine.

Just as with leg press, take a stance of about shoulder width and toes slightly pointed out. Throughout the movement, be sure to keep knees tracking over your 2nd toe. It is recommended (especially for rehab purposes) to take 2-3 seconds on the way down and pause for 1 second at the bottom position (at least parallel, or hip crease in line with top of knee). This is designed to encourage slow and controlled repetitions.
Exercise 3: Lunges

From a normal stance position take a long stride forward. While keeping your torso upright bend your leading leg until the opposite knee touches the ground gently. You should feel at least 80% of your body weight supported by the leading leg. From this point, straighten your front leg explosively to return to the exact starting position next to rear foot in one swift motion. If you perform this exercise proficiently you will not need to reposition the rear foot at any point.

Exercise 4: Knee extension

Starting position should be with knees bent to at least a 90-degree angle. To perform movement: straighten your legs, hold end position for 1 second, then take 3 seconds to return to start position.
Exercise 5: Wall Slides

Begin by leaning against the ball and with feet slightly further ahead. To perform movement: take 3 seconds to lower yourself down until there is at least a 90-degree bend at the knees, pause for 1 second, then return to start position. The advanced variation is to perform the same movement with a small ball squeezed between both knees.

Tips to prevent recurrent episodes of patellofemoral pain:

1) Do regular strengthening exercises and stretches. Just because you no longer have pain is no reason to stop. Remember, if you stop using your muscles you will lose them!
2) Stay active – taking part in regular exercise will help keep you strong. Adults are advised to do 150 minutes of moderate to vigorous physical activity a week.
3) Wear supportive footwear as often as possible.
4) Lose weight through a combination of a healthy diet and regular exercise as being overweight (BMI>25) increases risk of developing patellofemoral pain.
References


Visit us at www.frankgilroyphysiotherapy.co.uk for more information.