Patellofemoral syndrome in an Active female

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Abstract

Patellofemoral joint pain is one of the most common types of knee pain which affects between 15-45% of the population, particularly adolescents and young adults. This is due to the variable anatomical presentations of the joint which has minimal bony stability. This subject of this case study was a 25 year old active female who had a history of chronic bilateral anterior knee pain. This paper describes how a Pilates conditioning program using the BASI Block System® and a variety of apparatus can be used to carry out a post rehabilitation conditioning program. This program not only addresses specific muscle imbalances that directly affect the biomechanics of the knee complex, but it also promotes improved posture and core strength. The goal of the program is reduce the frequency and intensity of further pain episodes, improve flexibility and strength of the lower extremities, spinal articulation and core strength. The program outlines a graduated approach over an eight week period.
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Anatomy of the Patellofemoral joint.

The patellofemoral joint is a complex structure which includes both static and dynamic components. The static elements are made up of the bones and ligaments while the neuromuscular system is the dynamic component (Kim Y-M et al 2012).

The patella is situated distally from the muscle bulk of the quadriceps that forms the patellar tendon. It is shaped like an inverted triangle, the superior surface forms the base and the inferior patella forms the apex (Loudon 2016). Most of the articulating surface is covered with a layer of articular cartilage which is up to seven millimeters thick (Grelsamer et al 1998). The thickness of the articular layer may dissipate joint reaction forces that are created during strong contractions of the quadriceps muscle (Loudon 2016).

The patellofemoral joint is stabilized by the patellar retinaculum especially in the medial and lateral planes (Navarro et al 2010). The medial and lateral Patellofemoral Ligaments act as stabilizers against subluxation or dislocation (Borbas et al 2014). The joint capsule and patellar also contribute to static stability (Loudon 2016).

The Patella is surrounded by the quadriceps tendon. The vastus medialis oblique muscle (VMO) attaches to the mid-section of the patella as well as to the medial patellofemoral ligaments and the tendon of adductor magnus. The VMO provides a medial stabilizing force to
the patella (Goh et al 1995). Lateral dynamic reinforcement is provided by the vastus lateralis in addition to the iliotibial band and the superficial oblique retinaculum. (Terry et al 1986). The rectus femoris inserts on the superior base of the patella (Lieb 1968) and the patella is attached inferiorly to the tibial tubercle by the patellar tendon.

Biomechanical dysfunction due to variations in joint surface articulation and muscle imbalances is thought to contribute to Patellofemoral Joint Pain. This is because increased force distribution between the patella and the femur can result from unequal tensile forces from surrounding structures (Witrouw et al 2000).
Introduction

Patellofemoral pain is considered to be one of the most common types of knee pain. It presents as diffuse anterior knee pain that is non-traumatic in nature. The pain is usually aggravated by activities that load the joint such as squatting, running, climbing and stair climbing (Crossley et al 2016). It affects between 15% to 45% of the general population (Roush et al 2012) with a higher incidence and prevalence rates among females (Boling M 2010).

The following case study demonstrates how a Pilates Conditioning Program using the BASI Block System ® (Iscacowitz, R 2013) can be used to address this common condition.

Case Study:

Subjective history.

Kate is 25 year old female student presenting with a long standing history of intermittent bilateral anterior knee pain. She is an active person and had been attending a gym three to four times a week. Activities at the gym included a weight lifting class, aerobics, spinning and yoga. Kate had previously trained in ballet for 9 years which she had to discontinue as a result of her knee pain. Kate reported that the right side was more painful than the left side and felt like a dull ache accompanied with a sensation of muscle fatigue in the lower extremity. She had no complaints of lower back, hip pain or altered sensation. She did report discomfort in the right upper shoulder over the upper trapezius muscle. The knee pain was aggravated by walking, squatting, jump lunges, stairs (especially descending) and cycling. The pain was eased by rest, ice and or heat, warm baths, stretches and strengthening exercises that had been prescribed by a physiotherapist.
Postural assessment:

Observation of standing posture from the side view revealed the following deviations in the sagittal plane: forward head posture, mild hyper lordosis of the thoraco-lumbar junction, hyperextension of the left knee and increased pronation of the right foot. From the back view the left shoulder girdle was elevated and the right foot was placed forward of the left.

The Roll-down observed from the side showed increased cervical flexion and decreased lumbar flexion. Kate had good hamstring flexibility and there was no sign of scoliosis with observing the Roll-down from the back.

The goals of the conditioning program were to improve alignment and strength of the feet, knees and hips in order to correct existing muscle imbalances that were contributing to faulty tracking of the patella.

A second goal was to improve the tendency towards a sway back posture which was creating anterior rotation of the pelvis and decreased lumbo-pelvic stability.

The conditioning program using progressive layering of the BASI Block System ® featured an emphasis on foot work, initially on the reformer and progressing to the Wunda chair. Attention was paid to correct foot alignment especially in the parallel heels, parallel toes and small V positions to correct pronation of the forefoot.

Correct tracking of the patella was achieved through verbal cuing to “pull up the kneecaps” on terminal extension.

The goal of abdominal strengthening was to strengthen the rectus abdominus, external and internal obliques and transversus abdominus. This was to help with thoraco-lumbar alignment,
reduce hyper lordosis and improve lumbo-pelvic stability. Progression was made from the hundred prep and coordination on the reformer, Pike exercises on the Wunda Chair and oblique work on the Cadillac.

Hip work was used to further support correct length and function of the adductors, hamstrings and gluteals. It has been suggested through preliminary research that hip strengthening in addition to knee strengthening, versus knee strengthening alone, may help to alleviate patellofemoral pain syndrome (van der Heijden et al 2015). Special attention was paid to cuing adductor control during the supine leg series using springs on the Cadillac and maintaining correct tracking of the patellofemoral joint.

The spinal articulation block focused on correct alignment and sequential movement through the vertebrae progressing from simple Bottom Lift on the Reformer to Monkey Original and Tower prep on the Cadillac. The latter two exercises also promote calf and hamstring flexibility.

Adductor flexibility and strength was also addressed using the side split on the Reformer.

Postural imbalances were worked on using periscapular strengthening on the Reformer and Cadillac progressing from the Arms supine series to the Arms standing series.

Single leg skating on the reformer was used to strengthen the internal hip rotators gluteus medius and minimus emphasising correct patellofemoral alignment.

Periscapular stability and thoracic extension mobility where developed with the Extension block starting with Breaststroke Prep on the Reformer and progressing to Swan on Floor on the Wunda Chair.
**Conditioning Program:**

The following conditioning program was carried out three times per week of a period of 8 weeks using the BASI Block System ®

<table>
<thead>
<tr>
<th>Block</th>
<th>Week 1-2</th>
<th>Week 3-4</th>
<th>Week 5-6</th>
<th>Week 7-8</th>
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<tr>
<td>Abdominal Work</td>
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<td>Reformer: Coordination Hundred</td>
<td>Wunda Chair: Standing pike Cat stretch kneeling Standing Pike Reverse</td>
<td>Cadillac: Mini roll-up Mini roll-up oblique Roll Up top loaded</td>
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<td>Hip Work</td>
<td>Reformer: Supine Leg Series: Frog Circles down</td>
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<td>Cadillac: Supine leg series Frog Circles down Circles up Walking Bicycle</td>
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<td>Openings</td>
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<td>Extended frog Extended frog reverse.</td>
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<td>Spinal Articulation</td>
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<td>Reformer: Bottom Lift</td>
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<td>Bottom lift with extensions</td>
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<td>Stretches</td>
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<td>Cadillack: Shoulder Stretch</td>
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<td>Full Body</td>
<td>Reformer: Knee stretch: Round Back Flat Back</td>
<td>Reformer: Up Stretch 1 Elephant Reformer: Up stretch 1 Elephant Down stretch</td>
<td>Cadillack: Sitting Forward Side reach Thigh Stretch with Roll up Bar Saw</td>
<td>Integration (F/I)</td>
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<tr>
<td>Leg Work</td>
<td>Reformer: Hamstring Curl Reformer: Skating Single Leg</td>
<td>Reformer: Skating single leg</td>
<td>Wunda chair: Leg press standing Hamstring curl Hip opener</td>
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Conclusion

Patellofemoral pain is a common condition that affects primarily young adults particularly females. The patellofemoral joint has reduced stability due to its shallow and irregular joint surface with the femur. The stability of the joint is therefore reliant on the surrounding static and dynamic soft tissues. In particular the muscle balance between the contractile forces within the quadriceps and biceps femoris must be considered.

Pilates provides an ideal approach to achieve a balance between flexibility and strength throughout the body.

At the end of this graduated conditioning program the subject, Kate reported a 75% reduction in anterior knee pain and was able to resume all activities of daily living such as stair climbing, squatting and sitting with flexed knees without pain. On examination Kate exhibited improved posture with a reduced forward head position, decreased thoraco-lumbar kyphosis. She also exhibited improved positioning of the pelvis in standing and was able to access the neutral pelvis position in standing with more ease. In addition to improved tracking of the patellofemoral joints bilaterally she had decreased hyperextension of both knees and reduced foot pronation.

This is in perfect agreement with Joseph Pilates definition of physical fitness as being “the attainment and maintenance of a uniformly developed body with a sound mind fully capable of naturally, easily and satisfactorily performing our many and varied daily tasks with spontaneous zest and pleasure (Pilates, J 1945).
References


