

Anterior Knee Pain - Pain Site versus Pain Source

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Anterior knee pain goes by a large number of names but unfortunately seems to have relatively few effective treatments. Chondromalacia Patella, Patella Tendonitis and Patella-Femoral Syndrome are all names used to describe various types of often debilitating anterior knee pain. A large part of the problem in treating anterior knee pain may be that treatment has often focused on the knee joint or, what would be described as the primary pain site. In reality, the knee may be the repository of pain that emanates from issues at the hip or the foot. A knee-centered approach to treatment of anterior knee pain becomes a symptom-based approach versus a cause-based approach. In other words treatment often focuses on eliminating a key symptom versus trying to eliminate the cause.

Interesting enough current research is leading to the conclusion that many of the overuse conditions of the knee are not conditions of the knee at all. Anterior knee pain may in fact be more of a symptom than a diagnosis. All of the conditions mentioned in the opening sentence may in fact be related to poor stability at the hip but present as knee pain. (Powers, 2003) The analogy we have frequently used to describe why this occurs is what I refer to as the "rope analogy". If I put a noose loosely around your neck, stood in front of you, and pulled on it you would tell me that the back of your neck hurt. If I simply stopped pulling on the rope your neck pain would disappear. The fact of the matter is that nothing was ever really wrong with your neck. The neck was simply the endpoint at which you felt the pull. This is very similar to the effect of the glute medius and glute max pulling on the IT band and resulting in pain at the knee. The IT band transmits forces from the glute medius to the patella tendon. For some reason the patella tendon feels pain much like the back of the neck feels the pull from the rope.

Another potential cause of anterior knee pain may be an unintentional loss of ankle mobility. The zeal of athletic trainers to stabilize the ankle with shoes, tape and braces has led to many athletes playing with ankle joints that function as if they were fused. The reality is that in the sport of basketball (a leading sport for anterior knee pain) serious ankle sprains are less frequent and patella-femoral pain has reached near epidemic levels.

The desire to over-stabilize the ankle joint has led to a phenomenon we now call the "high ankle sprain" and to an epidemic of patella tendon issues. The high ankle sprain was virtually unknown twenty years ago and may also be a by-product of over-stabilizing the ankle. Interestingly enough soccer has few ankle or patella-femoral problems yet, soccer players use a low cut, lightweight shoe on grass. Training with less artificial stability at the ankle joint probably protects the ankle and the knee.

Over the past decade, Anterior Knee Pain has been blamed on poor VMO development, poor "patella tracking" and numerous other causes. Most treatments have centered on trying to reduce the pain at the pain site with various treatments (ice, taping, ultrasound etc.) The reality is that an aggressive strengthening program aimed from the hip down, particularly the eccentric control of knee flexion, adduction and internal rotation may in fact be more effective. The Ireland study (Ireland et al. 2003) states clearly that "females presenting with patella-femoral pain demonstrate significant hip abduction and external rotation weakness when compared to non-symptomatic age matched controls". Lower extremity strengthening done with emphasis on hip control in combination with a program of progressive single leg plyometric training to address the eccentric and neural stability components may allow many trainees to experience long-term relief.

Recent research has validated what up until now was an empirical feeling. Beginning three years ago all athletes training in our facility would be evaluated for hip pain (palpation of glute medius) when complaining of anterior knee pain. We found nearly a 100% correlation between Anterior Knee Pain and glute medius tenderness. All of our athletes with anterior knee pain had direct point tenderness in the glute medius of the hip on the effected side. Soft tissue work to the glute medius (foam roll, tennis ball, massage) caused a significant reduction in the pain at the patella in almost every case. Most also had

marked weakness in manual muscle testing for the glute medius. The conclusion is obvious. Weak hip stabilizers cause a lack of control of knee and hip flexion with an additional component of adduction and internal rotation. These control issues result in a painful sensation in the patella-femoral joint or the patella tendon.

Further study in the past year (Summer 2006) has caused us to look at the adductors, another hip stabilizer in the lateral sub-system. In 2006 in addition to looking at lateral hip structures as a potential causative factor in knee pain we also began to look at the strength and over-activity of the adductors. Upon further investigation we found weakness in the adductor muscle group, with a preference to substitute hip flexors for adductors, as well as obvious tender trigger points in the adductors.

The key from a both a cause and a solution standpoint lie in the sagittal plane dominant strength training so prevalent in the American system. Our American strength training system is classically sagittal plane dominant as well as double leg oriented. It seems clear that the key to solving anterior knee pain lies in control of hip, knee and foot movement in the frontal plane and that single leg exercises must be employed in both strength training and power training to address these issues.

In addition the single leg strength training must center around what we have termed single leg unsupported exercises like one leg squats and one leg deadlift variations. Knee dominant single leg exercises like split squats and rear-foot elevated split squats (sometimes referred to as Bulgarian squats from Spassov's work) may provide adequate stress in the sagittal plane but do not provide adequate stress to the hip structures in the frontal or transverse planes. The athlete must be standing on one foot with the opposite foot having no contact with either the floor or any other object. In essence the act of standing on one foot and performing a single leg squat becomes a tri-planar exercise even though the athlete is moving in only the sagittal plane. Having only one foot in contact with the ground forces the hip structures (abductors and external rotators) to stabilize against movement into both the frontal and transverse planes. In these single leg unsupported exercises we will allow less than full ROM to develop hip control. This is a major exception in our system of training as we have always used full range of motion exercises. The objective is always to get to a full pain free range (see figure 1) with bodyweight before the addition of any external resistance.

The exception will be the addition of five pound dumbbells to allow weight shift toward the heel. We have dubbed this concept progressive range of motion exercise. The progression is in range versus load to cause the progressive control of hip motion.

The following treatment program is suggested for patella-femoral pain syndromes:

Step 1- Soft tissue work to glute medius with tennis ball and foam roll or by a qualified therapist, trainer etc. if available.

Foam Rolling Techniques

Step 2- use of Reactive Neuromuscular Training for the hip abductors in conjunction with a strengthening program for the knee and hip extensors focusing on single leg unsupported exercises and progressive range of motion if necessary.

The term Reactive Neuromuscular Training can be confusing as the same term has been used by two well-respected physical therapists to describe two entirely different thought processes. Mike Clark of the National Academy of Sports Medicine uses the term Reactive Neuromuscular Training for all intents and purposes in place of the term plyometrics. Physical Therapist Gray Cook on the other hand uses the term Reactive Neuromuscular Training to apply to an entirely different thought process. Cook's concept of Reactive Neuromuscular Training involves applying a stress to a joint in opposition to the action of the muscles. In other words to effectively target the hip abductors a band is placed around the knee and the

leg is pulled with an adduction force. The addition of the adduction force will in effect "turn on" the abductors.

Single Leg Unsupported with Progressive Range of Motion Increases and RNT Emphasis is a mouthful. The key is that the athlete is standing on one foot. In a therapy or personal training situation the adduction force can be provided by the therapist or trainer with Theraband etc. In a groups situation the adduction force can be provided by a piece of Theratube as indicated in figure 2. In figure 2 the glute medius fires to counter the adduction force of the tubing (idea of courtesy of Shad Forsythe, Performance Specialist, Athletes Performance-Los Angeles)

-Single Leg Unsupported

-RNT to Glute Medius

Step 3- Hip Extension Strengthening- strengthening the hip extensors must include three distinctly different patterns. Pattern one is a straight leg pattern as in the one leg straight leg deadlift (actually a misnomer as the knee is intentionally bent to twenty degrees.)

Pattern two is a bent leg pattern that incorporates the mechanics learned in the bridging exercises from core training. Pattern 3 is a leg curl pattern incorporating the hip extensor function of the glutes.

Pattern 1- Single Leg Good Mornings, 1 Leg SLDL, Low Pulley Anterior Reach (20 degree knee flexion, flat back), Single Leg Pull Throughs. (Figure 3)

Pattern 2- Bridge and Single Leg Bridge Variations beginning floor based and working from a BOSU to a peanut shaped stability ball (1 plane of instability) and finally to a stability ball (multi-planar instability). These exercises target the glutes and with the addition of instability the hip rotator group.

Figure 3- Pattern- 1 Leg Straight Leg Deadlift

Figure 4- Single Leg Elevated Bridge Finish

Figure 5- Single Leg Elevated Bridge- Start

Pattern 3- Slideboard leg curl variations. The key with the slideboard leg curl is that the glutes function isometrically to maintain hip extension while the hamstrings act to flex and extend the knee. Any flexion of the hip negates the effectiveness of this class of exercises. Even one degree of motion at the hip negates the glute function. The best teaching progression is to begin in a bridge with glutes and abs contracted and eccentrically lower into an extended position.

Step 4- Concentric training of Hip Abductors -- although many would argue that isolated single joint training is not functional it is still necessary to train the concentric action of the hip abductors. This can be done with simple side leg lifts or with standing abduction on a Pilates Reformer or MVP Shuttle.

Additional Points of Emphasis

Core-

Core training should always be included in any sound program but, with patellafemoral pain both quadruped and bridge variations should be used for emphasis on glute max and glute med function.

Conditioning/ Muscle Endurance-

Retro walking is another excellent exercise for the athlete or client with patella femoral pain. Backward walking provides less stress to the patella-femoral joint and is in fact a series of closed chain terminal

knee extensions. Backward walking can begin with a treadmill program of intervals at progressively higher inclines and progress to walking backward with a weighted sled.

Eccentric Strength-

Eccentric strength work should focus on single leg plyometrics with emphasis on landing skills, jumps should be forward as well as medial and lateral. In addition the MVP Shuttle can be used to develop landing skills for athletes returning from injury or athletes with poor strength to bodyweight ratios.

The key to battling patella femoral pain is adopt a well rounded approach that works on the source of the pain versus the site of the pain and takes into account all of the functions of the lower extremity.

Figure 6- Slideboard Leg Curl

Hip Dominant Exercises

Eccentric Plyometrics

Bibliography

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