Running injuries can be frustrating and take both a physical and mental toll on the athlete that they affect. Several injuries can literally even be classified as a “pain in the butt.” The posterior region of the hip is an area frequently injured in the running community. Symptoms can range from recurrent sensations of diffuse soreness to sharp, localized pain with compression and/or exercise. The 2 most common injuries affecting the posterior hip/gluteal region are **“High” Hamstring Strain / Tendinopathy** and **Piriformis syndrome**. It is important for athletes to recognize and acknowledge symptoms early on as these two conditions can warrant an immediate change in training volume and intensity. Training through these injuries could exacerbate the problem and leading to poor workout/race performance as well as future need to seek professional care.

**Relevant Muscle Anatomy**
To better understand how muscles are injured, it is important to understand what actions they are responsible for. The chart below lists the planes of hip motion as well as the primary muscles involved with each individual plane.

<table>
<thead>
<tr>
<th>Motion</th>
<th>Muscles Involved</th>
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</thead>
<tbody>
<tr>
<td>Hip Forward (flexion)</td>
<td>Iliopsoas and Rectus Femoris</td>
</tr>
<tr>
<td>Hip Back (extension)</td>
<td>Gluteus Maximus, Hamstrings</td>
</tr>
<tr>
<td>Hip Out (abduction)</td>
<td>Gluteus Medius, Tensor Fascia Lata</td>
</tr>
<tr>
<td>Hip In (adduction)</td>
<td>Adductors (Longus, Brevis and Magnus)</td>
</tr>
<tr>
<td>Internal Rotation</td>
<td>Gluteus Medius (anterior fibers)</td>
</tr>
<tr>
<td>External Rotation</td>
<td>Piriformis, Gemellus (superior &amp; inferior), Obturators (internus &amp; externus), Quadratus Femoris</td>
</tr>
</tbody>
</table>

**“High” Hamstring Strain / Tendinopathy**
Due to its location, “high” hamstring injuries at the ischial tuberosity (the “sit bones”) are often much slower to heal than strains in other areas of the body. Injury to this area can last a year or longer if it is not taken care of properly. Symptoms would include aching to sharp pain with tenderness at the ischial tuberosity during or after exercise (particularly with speed work and hill training), when stretching the hamstring, bending the knee against resistance as well as pain with prolonged sitting, especially on harder surfaces. Hamstring injuries are a common problem that are, for the most part, avoidable. Like many other injuries, hamstring problems are not 100% preventable, but there are many ways to help reduce the occurrence.
Causes:

Common causes of hamstring knots, strains and tears range from mineral imbalances, muscle imbalances, dehydration, biomechanical problems and over-training. Thus you can see that nutrition comes into play immediately. Eating a proper diet and getting the adequate amount of water each day can reduce the onset of muscular problems. Muscle imbalances (quadriceps/hamstring ratio) are usually pointed to as the key causative factor however this seems to only play a minor role in hamstring injuries. The correct muscle balance of quadriceps to hamstring strength should be 3:2. In general, the rule for healthy hamstrings is that they can lift 60 - 80% of what your quads can lift.

Biomechanical issues seem to be the biggest component for hamstring problems. Athletes that break at the hips (anterior pelvic tilt / arched back) when they run tend to be the most prone to developing hamstring problems. Anterior pelvic tilt affects hamstring length because the hamstring is attached to the bottom of the pelvis. If the pelvis is anteriorly tilted or rolled forward, the hamstring is going to be in a stretched/lengthened position. The hamstring needs to be able to handle a rapid and forceful stretch generated at foot strike while it is also trying to extend the hip at the same time. The hamstring that is lands in an already lengthened position must be able to handle a great deal of tension beyond what it is normally subjected which leads to eventual problems.

An anterior pelvic tilt (arched back) also alters where an athlete’s foot will contact the ground relative to their center of gravity (COG). Poor ground contact position where the foot strikes out in front of the COG places the hamstring at risk for developing problems. If the athlete's foot is striking down out in front of the COG, this causes a breaking force that will not only slow the athlete down, but create tremendous force on the hamstring. Thus as a rule, if you are looking straight ahead while you are running and can see your feet with your peripheral view, chances are that you are striding out in front of your COG and paving the path towards eventual hamstring injury.

Over-training is also a common reason for hamstring related problems. For training programs that either have too many speed days in a row, they aren't allowing runners an adequate amount of recovery time. Also watch out for introducing too much volume on recovery days because the body will still be in a fatigued state the following day and if this is a speed day, muscle injury will be more likely to occur. Proper recovery is the most important aspect of training.

Treatment:

- Muscle work (e.g. Active Release Therapy, Graston Technique, cross friction massage, myofascial release) to release scar tissue in the hamstring and reduce tension on the musculotendinous attachment at the pelvis.
- Sacroiliac Joint Assessment / Manipulation to be sure that the pelvis is not restricted in an anterior position keeping the hamstring in a lengthened/vulnerable state.
- Light stretching (only to the point of “LIGHT TENSION”. Be sure that it doesn't aggravate the hamstring and produce more pain)
- RICE - Rest, Ice (20 minutes on and off), Compression, Elevation
- Ice compress is used to stop the internal bleeding immediately following injury
- Do not heat right after hamstring pull - promotes bleeding to the injury site
- Do not use aspirin after immediately after injury (promotes additional bleeding to the affected area)
- Electrical Muscle Stimulation (EMS) can be used above the injury site to promote blood flow as well as Pulsed Ultrasound to stimulate healing.

Complications:
Occasionally fibrous adhesions may develop on the tendon in chronic cases. These fibrous adhesions can irritate the sciatic nerve as it passes above the ischial tuberosity and then down past the long head of the hamstring. This can lead to delayed healing even with treatment.

Piriformis Syndrome

Overview:
The piriformis is a muscle that travels behind the hip joint and is responsible for external rotation of the hip. This means that as the muscle works, it helps to turn the foot and leg outward.

Problems in the piriformis muscle can cause problems with the sciatic nerve. This is because the sciatic nerve runs underneath (and sometimes through) the piriformis muscle on its way out of the pelvis. The piriformis muscle can squeeze and irritate the sciatic nerve in this area, leading to the symptoms of sciatica. The Sciatic nerve is the largest nerve in the body and supplies the lower extremities with motor and sensory function. It travels directly underneath the piriformis muscle and superior to muscles called the gemelli. In about 15% of the population, the nerve passes through the piriformis itself or above it rather than below it.

The usual complaint is numbness or tingling in the buttock and posterior thigh, occasionally with symptoms in the lower leg and foot. The area around the muscle as well as the piriformis itself is often tender to compression. Active or resisted external hip rotation may exacerbate the pain. Athletes may prefer to stand with their leg in slight external rotation to relax the muscle and decrease their symptoms.

Causes:
Common causes of Piriformis Syndrome are excessive pronation and blunt trauma (e.g. fall on the buttocks). As the foot pronates excessively, it causes the lower leg and upper thigh to compensate and rotate internally. The piriformis now reacts, forcing it to contract excessively in order to stabilize this repetitive internal torsion of the lower leg and thigh. Similar to other muscles, when the piriformis and external hip rotators are subjected to repetitive stress, it causes scar tissue to accumulate within the muscle, making it weaker and tighter. The condition begins when the piriformis muscle goes into spasm and tightens against the sciatic nerve, squeezing the nerve against the bone of the pelvis irritating the sciatic nerve.

The muscle may also be injured due to a fall onto the buttock. Bleeding in and around the piriformis muscle forms a hematoma. A hematoma is when blood has pooled in the injured area. The piriformis muscle begins to swell and put pressure on the sciatic nerve. Soon the hematoma dissolves, but the muscle goes into spasm as a result.
Treatment:
- Muscle work (e.g. Active Release Therapy, Graston Technique, cross friction massage, myofascial release) to release scar tissue at the Piriformis and external hip rotators focusing on freeing up adhesions between the muscle(s) and the sciatic nerve
- Motion assessment / manipulation of the entire lower kinetic chain: sacroiliac joints, hip joints
- Gait assessment and examination of the foot/ankle to determine if a change in footwear or prescription of orthotics is warranted.
- Heat application: to help the piriformis muscle relax, easing spasm and pain.
- Ultrasound is another treatment choice that can be set for deep heating in the buttock area. Ultrasound uses high frequency sound waves that are directed through the skin. The deep heating effect of ultrasound is ideal for preparing the piriformis muscle for hands-on forms of treatment and for getting the muscle to stretch out.
- Stretching - stretching is especially effective following heat and hands on treatment. You need to do your stretches every few hours. Be gentle and cautious as you stretch to avoid going to deep into your stretch. As your symptoms ease, focus should be on gradually advancing your program to include posture training, muscle strengthening, and general conditioning.

Complications:
Their are other causes that can elicit "deep buttock pain." Differential diagnoses include spinal problems (such as herniated discs, spinal stenosis, etc.), sciatica, and tendonitis. The diagnosis of piriformis syndrome is often given when all of these diagnoses are eliminated as possible causes of pain.