Anatomy:
The hamstrings are formed by three muscles and their tendons: the semitendinosus, semimembranosus and biceps femoris. The hamstrings start by connecting to the ischial tuberosity, the small bony projection on the bottom of the pelvis, just below the buttocks. The hamstrings run down the back of the thigh with the tendons crossing the knee joint and connecting to the side of the tibia (shinbone).

Hamstring muscle fibers join with the tough, connective tissue of the hamstring tendons near the points where the tendons attach to bones. The hamstrings function by pulling the leg backward and by propelling the body forward while walking or running (hip extension); they also bend the knees (knee flexion).

Causes/Mechanisms of Injury:
A hamstring injury can be a pull, partial tear, or a complete tear. Muscle strains are graded according to their severity; Grade one – mild strain and usually heals rapidly, Grade two – moderate strain with more muscle fiber damage but not a complete rupture, Grade three – severe injury/complete tear of the muscle that make take months to heal.

Hamstring injuries happen when the muscles are stretched too far. Sprinting, fast or twisting motions with the legs, jumping, kicking, water skiing, dancing, weight lifting, and ice-skating are common causes of hamstring injuries. Low levels of fitness and poor flexibility contribute to higher risk of injury. Muscle fatigue and not warming up properly can also contribute.

Symptoms:
In severe cases, an athlete may hear a sudden pop and fall to the ground; the athlete may be able to walk with only mild pain. In less severe cases a tight feeling or pulling in their hamstring that slows your down may occur.

Additional symptoms may include:
- Swelling during the first few hours after injury
- Bruising or discoloration of the back of your leg below the knee over the first few days
- Weakness in your hamstring that can persist for weeks

Treatment/Management:
It is very important to treat and rehabilitate your hamstring injury correctly. Incomplete or improper healing makes re-injury much more likely. For the first three to five days after the injury the main goal of treatment is to control the swelling, pain and hemorrhage (bleeding). Initially treated with RICE method:

Rest – rest is critical. A short period of immobilization may be recommended, while for severe tears a longer period of rest will be required. Using crutches may enable your ability to rest your hamstring. If
you put too much weight on your hamstring after injury, more damage may occur and more scar tissue may form.

Ice – ice applied to the injured hamstring controls swelling and pain but does not stop it completely. Cold treatments reduce your sensations of pain by numbing the area which helps you relax, reducing muscle spasms.

Compression – compression can help reduce the bleeding in your muscle to limit swelling and scarring.

Elevation – elevation can help reduce swelling. The key to elevation is to raise and support the injured body part about the level of the heart.

Medication – nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprophene, to help relieve the swelling and pain may be used. Pain relief is the major benefit of NSAID use.

Surgical Repair – for grade three strains or complete tears surgery will be needed to reattach the tendon to the pelvis.

Nonsurgical Rehabilitation – physical therapy for strengthening and mobility will be beneficial to heal the musculature and regain function. Stretching will be a key feature of rehabilitation.

Exercises/Post Op Protocol:
**Acute Phase (1-5days)** – treatment geared towards decreasing inflammation and maintaining ROM. Using RICE and protection is an effective way to treat initially.
- When pain has decreased, painless gentle passive range of motion and active-assistive range of motion can be performed.
- Use of crutches or cane may aid walking.
- Return to participating in sporting activity should occur once rehabilitation is completed

**Subacute Phase (5 days to 3 weeks)** – the inflammation if the injury appears to be lessening. The goal of treatment in this stage is to begin some active range of motion and start strengthening
- Aquatic therapy is helpful in encouraging activity with decreased weight bearing.
- Transcutaneous electrical nerve stimulation (TENS) unit can be used for pain relief
- Pain-free submaximal isometric exercises are encouraged.
- Resume cardiovascular training

**Remodeling Phase (1 – 6 weeks)** – when the patient is able to perform isometric exercises at 100% effort without pain.
- Prone isotonic hamstring exercises are added to TENS unit and ice
- Unilateral exercises with low weight and high number of repetitions
  - Slowly increase the weight as tolerated as long as the patients pain is not increased – rapid increase in weight could lead to a long-term (chronic) injury
- Continued stretching of the hamstrings is essential and should occur prior to exercise.

**Functional Stage (2 weeks to 6 months)** – the patient should have a normal gait pattern and can begin fast walking.
- When the patient can walk for 20-30 minutes at a fast speed without pain or stiffness, short periods of jogging can be added to the fast walking.
- When the patient can perform a 15-30 minute jog then short periods of sprinting may be added to the jog.
- Continued hamstring stretching and strengthening

**Later Stages of Therapy** – plyometric exercises may be used to increase speed and power during training.
- Muscle stretching followed by a concentric (shortening) contraction, allowing for a stronger contraction because of muscle facilitation and decreased inhibition.
- Low-level exercises may be used initially, followed by higher-level exercises as tolerated (with supervision).