What is it?
Myositis ossificans is a condition stemming from an injury that can occur in many types of sports. In this condition, bone tissue forms within a muscle. When a bruise (contusion), repetitive trauma, or strain occurs to a muscle, myositis ossificans can develop. However, myositis ossificans only occurs in 9-17% of muscle bruises. It is most common in the thigh muscles, which include the hamstrings and quadriceps, the muscles in the back and front of the thigh, respectively. Myositis ossificans can also occur in other muscles. Bony tissue formation can occur 2-4 weeks after the muscle injury or bruise. The athlete will often complain of pain in the muscle associated with exercise. Range of motion and strength of the limb may be compromised. A hard bump may also be felt in the muscle.

Causes
When a muscle is injured or bruised, bony tissue can be deposited into the bruise during the healing process. While the exact cause of this reaction is unknown, athletes who subject the area to repetitive trauma before it is able to fully heal are more likely to have calcification and bony formation in the injured muscle. Additionally, not taking measures to reduce inflammation in the muscle after the initial injury also leads to an increased risk of developing myositis ossificans. Calcification typically occurs 2-4 weeks after the initial muscle injury and the bone fully matures by 3-6 months.

Risk factors
- Not appropriately resting muscle after a bruise or muscle strain, thus causing repetitive injury to the injured muscle.
- Not taking measures to reduce inflammation and swelling in the injured muscle, including not icing or applying compression.
- Intensive stretching, therapy, or massage after an injury are thought to increase bleeding into the muscle and inhibit healing, thus leading to myositis ossificans.
- Premature return to sport.
- Re-injury to the same area as a previous injury.

Symptoms
Persistent pain in previously injured muscle. While muscles can take months to get back to full strength following a strain or a bruise, typically, after 2-3 weeks there should be continued improvement in pain and performance. If pain, range of motion, and strength have not begun to improve or get worse at a month after the injury, the cause could be myositis ossificans. In addition to pain, swelling or a hard bump are signs of myositis ossificans.

Sports Medicine Evaluation
A sports medicine physician will ask the athlete questions about the initial injury as well as their progression, including improvement or worsening of symptoms. The physician will ask about the athlete’s training program, initial treatment, and their rehabilitation program. The physician will examine the affected area to determine the location of the pain and assess strength or flexibility. They may watch the athlete walk, run, jump, or balance.
If there is suspicion of myositis ossificans, either an ultrasound or x-ray will be performed to assess for calcifications within the muscle. Sometimes, radiographs initially will be negative and, at a later date, show bone tissue. Serial imaging to follow the progression of the bone formation may be obtained at subsequent appointments. MRIs are not typically ordered unless there are questions regarding the diagnosis, or there are concerns for complications.

**Treatment**
Treatment is initially conservative, as calcifications can be reabsorbed by the body, and some patients can fully recover despite calcifications, if treated properly. Conservative treatment includes rest from activities that strain the muscles, or less commonly, immobilization of the affected muscle. These measures that limit further repetitive trauma can promote spontaneous resorption of the calcification, and thus, healing. Anti-inflammatory medications such as naproxen or ibuprofen may help but using these is controversial; these medications may also increase the risk of bleeding into the muscle early in the course of the injury. Physical therapy is commonly prescribed. Initially, after a muscle injury, aggressive stretching should be avoided, as this can increase bleeding or inflammation. Physical therapy may include light stretching, early strengthening of surrounding muscles, followed by working on the strength and flexibility of the injured muscle itself. Ultrasound and light massage therapy may also help. Rarely, surgical removal of the calcification is pursued, especially when the patient still has severe symptoms despite months of conservative therapy. Surgery is more strongly considered if range of motion is limited, if nerve irritation occurs, or if the calcification limits the quality of life. Calcifications often reoccur despite removal especially if done before the bony tissue fully matures. If surgical therapy is considered it should only be pursued 6-12 months after the injury. Even when surgical treatment is delayed, reoccurrence is possible.

**Injury Prevention**
Myositis ossificans more commonly occurs with repetitive trauma; thus, avoiding trauma to a muscle after a contusion or strain can prevent occurrence. Sometimes, protective padding over an injured muscle can also help. Stretching to prevent muscle strain, as well as wearing appropriate protective equipment, can help.

**Return to Play**
Full return to play can occur without full resolution of the bone formation. Return to play is guided predominantly by the comfort and function of the athlete. Prior to return, an athlete must have full range of motion and strength of the affected muscle. They must be able to fully perform the tasks of their sports and position. The area should be adequately protected to avoid further trauma.

**References**