Hughston Health Alert

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Inside...

Cycling Overuse Injuries of the Knee

The economy and higher gas prices are straining wallets and making cycling a more attractive mode of transportation. Health enthusiasts use cycling as a low-impact exercise to improve overall fitness and minimize knee pain. Cities throughout the country are turning old, abandoned railroad lines into miles of beautiful biking trails and adding bike lanes to existing roads. In essence, cycling is becoming one of the nation's most popular pastimes.

Cycling has many health benefits; you can tone your muscles, improve your cardiovascular fitness, and burn as many as 300 calories an hour during a steady ride. People often turn to cycling as a form of exercise and enjoyment because it is a low-impact exercise that is easy on the knees. However, cycling can cause knee injuries, and often, the injuries are related to overuse, poor training, and poorly fitting equipment (**Fig. 1**). Injuries from cycling can be the result of an accident or from overuse.

Overuse injuries

Cycling overuse injuries occur over time from repetitive stresses on bone, joint, and

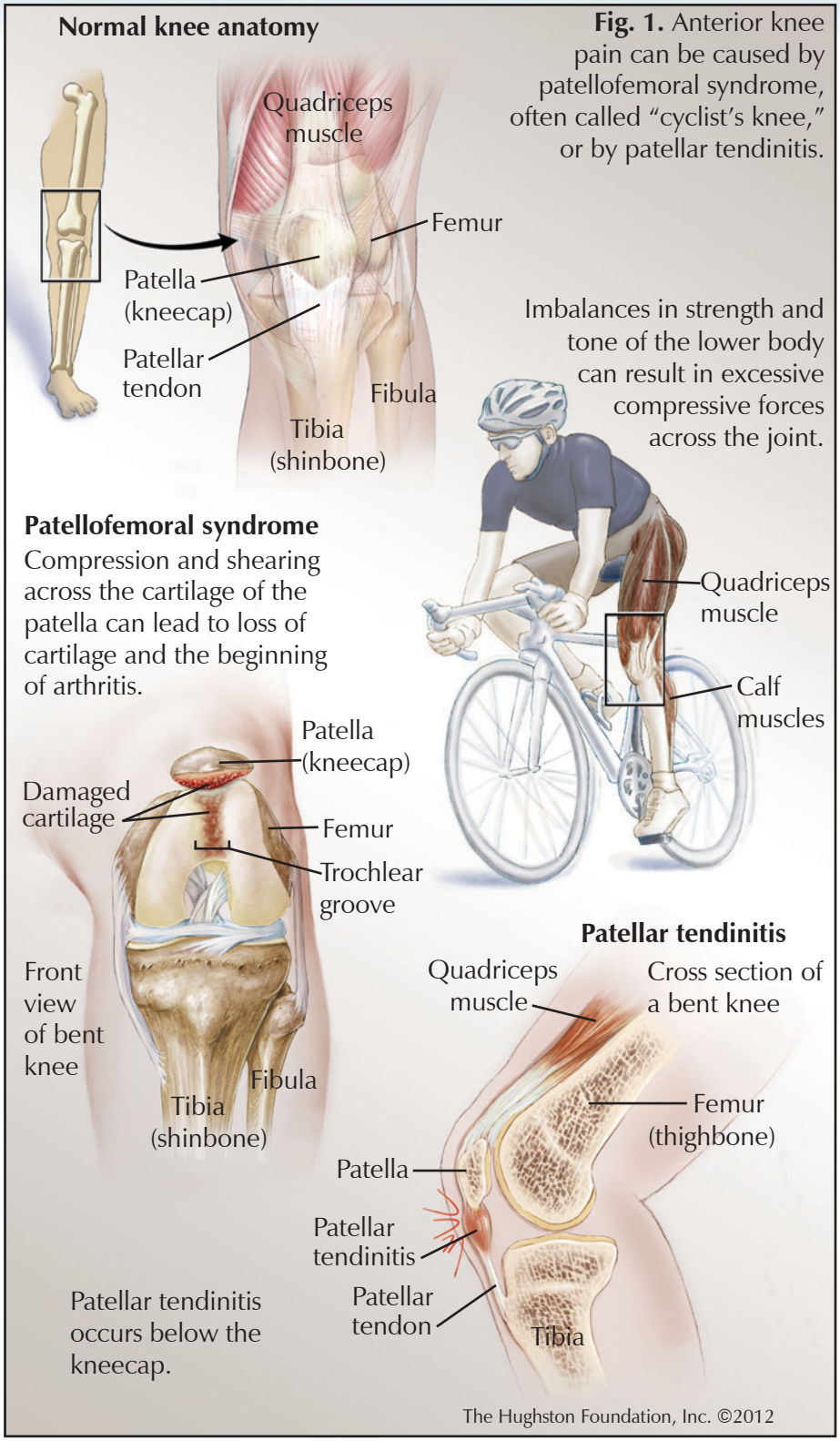


Fig. 1. Anterior knee pain can be caused by patellofemoral syndrome, often called "cyclist's knee," or by patellar tendinitis.

soft tissue with inadequate recovery time between rides. The knee is the most common site of overuse injury in cyclists, accounting for 40% to 60% of complaints. The unique position of the knee—connecting the strong hip muscles to the weaker leg muscles—places it at the center of a seesaw-type strength imbalance. Knee pain can be divided into different types based on the location of the pain. Anterior (front) knee pain can be caused by patellofemoral syndrome, often called "cyclist's knee," or by patellar tendinitis. Pain on the medial, or inner, side of the knee can be caused by pes anserine bursitis or by medial patellar plica syndrome. On the lateral, or outside of the knee, pain can be caused by iliotibial band syndrome.

Patellofemoral Syndrome

Patellofemoral syndrome is the result of several contributing factors. The pain is caused by increased pressure across the patellofemoral joint, resulting in shearing and compression of the cartilage surrounding the patella (kneecap) and its corresponding groove (trochlear groove) on the femur (thighbone) (**Fig. 1**). The balance between the quadricep, hamstring, hip, and calf muscles are continuously disrupted. At the center of this tug-of-war are the knee joint and its most vulnerable part, the patellofemoral joint. The imbalances in strength and tone result in either maltracking of the patella up and down the femoral aspect of the knee joint or excessive compressive forces across the patellofemoral joint. To make matters worse, the maltracking can lead to excessive compressive forces, as well. The compression and shearing across the cartilage of the patella can lead to chondromalacia, or loss of cartilage, and the beginning of arthritis. Excessive pressure across the patellofemoral joint can be caused by hill climbing, riding in high gears, and a slow cadence, or rotation.

RICE (*R*est, *I*ce, Compression, *E*levation)

Essential elements for managing pain and swelling

- **Rest** from your activity to allow the affected area to heal and to avoid further trauma to the injury.
- **Ice** can be applied for 20 minutes, 3 times a day to help eliminate swelling and discomfort.
- **Compression** can be applied using an elastic bandage or another type of compressive stocking to further combat swelling.
- **Elevation** can be accomplished by supporting the leg so it is above the level of the heart. This helps decrease swelling in the affected area.

Patellar tendinitis

Patellar tendinitis is an overuse injury that affects the tendon that connects your patella (kneecap) to your tibia (shinbone) (**Fig. 1**). During cycling, the patellar tendon helps your muscles to extend your lower leg to push the pedal of your bike. Patellar tendinitis occurs when you repeatedly overload the knee's extensor mechanism (the muscles, ligaments, and tendons that stabilize the joint) causing tiny tears in the tissue in and around the patellar tendon. If you continue cycling without adequate rest, the tears will continue and not have time to heal. Pain often occurs at and around the kneecap during and after cycling with inflammation and swelling. Initial treatment should be to stop cycling, implement the RICE regimen (*R*est, *I*ce, *C*ompression, *E*levation), and take nonsteroidal anti-inflammatory medication, such as aspirin or ibuprofen. Treatment and prevention should focus on restoring knee balance using strengthening and stretching exercises. A reduction in cadence and activity is essential to provide time for recovery and healing. Adjusting the seat and foot positions can also help to prevent recurrence of the problem.

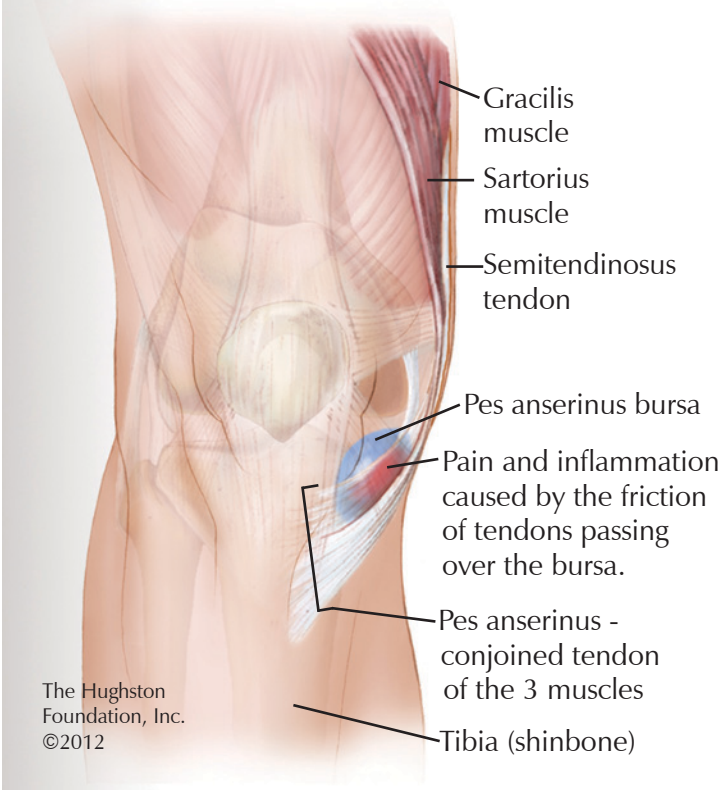
Pes anserine bursitis

The pes anserinus bursa is a small lubricating sac located between the head of the tibia (shinbone) and the insertion of the 3 tendons of the sartorius, gracilis, and semitendinosus muscles at the inside of the knee (**Fig. 2**). Inflammation of this bursa can result when the tendons cause friction while passing over the bursa. The inflamed bursa becomes painful and tender. Exposure to constant friction without adequate rest between rides, neglecting to stretch, sudden increases in mileage, and tight hamstring muscles often cause bursitis in cyclists. Treatment consists of hamstring stretching to relieve the stress across the bursa, use of anti-inflammatory medication, and physical therapy to restore knee balance. A cortisone injection into the bursa can also be helpful.

Patellar plica syndrome

During fetal development, 3 compartments of the knee develop into 1 large protective cavity called the synovial membrane. Often, a plica (a thin wall of fibrous tissue that is a remnant of the 3 cavities) can be found in adults as an extension of the synovial capsule, which is the lining of the knee joint. The plica can be located anywhere in the knee, but the most common location is along the medial, or inside, of the knee (**Fig. 3**). The band of tissue can become irritated by the bony structures of the knee during flexion and extension. The constant rubbing starts a cycle of thickening and inflammation of the plica that can lead to more pain and popping that can be heard and felt at the knee. Treatment begins with recognizing the anatomical cause of the problem and treating it with rest, hamstring stretching, anti-inflammatory medications, and physical therapy to restore knee balance. In difficult cases, surgery to remove the plica can be helpful in resolving the pain.

Fig. 2. Pes anserine bursitis



Iliotibial (IT) band syndrome

IT band syndrome affects the lateral, or outside, of the knee and is caused by inflammation in the lower portion of the IT band. The IT band is a thick, fibrous band of tissue extending from the iliac crest of the hip to the lateral portion of the shinbone below the knee joint. Because it spans both joints, IT band syndrome can cause pain at the hip as well as at the knee. Often, repetitive cycles of hip and knee flexion and extension cause the band to thicken as it rubs over the outside portion of the thighbone creating friction and irritation. When a cyclist rides with his or her seat positioned too high, the knee is in extension more than usual during a cadence. Treatment consists of IT band stretching at both the knee and hip, taking anti-inflammatory medications, and restoring knee-muscle balance with physical therapy. Cortisone injections can also be helpful.

Prevention tips

Stretching. Over time, cyclists can develop stronger, tighter, and shorter calf muscles that cause tightness in the Achilles tendons and hamstrings. Strong leg and lower back muscles can cause an imbalance in muscle strength. Without proper stretching, the tightness can cause an overuse injury. Stretching should be done as much as possible throughout the day, even when you are not cycling. Hughston Clinic physician Kurt Jacobson, MD, says, "Stretching is only effective for 2 hours, so it's necessary to stretch all day long," to achieve the required resting tone needed to avoid injury.

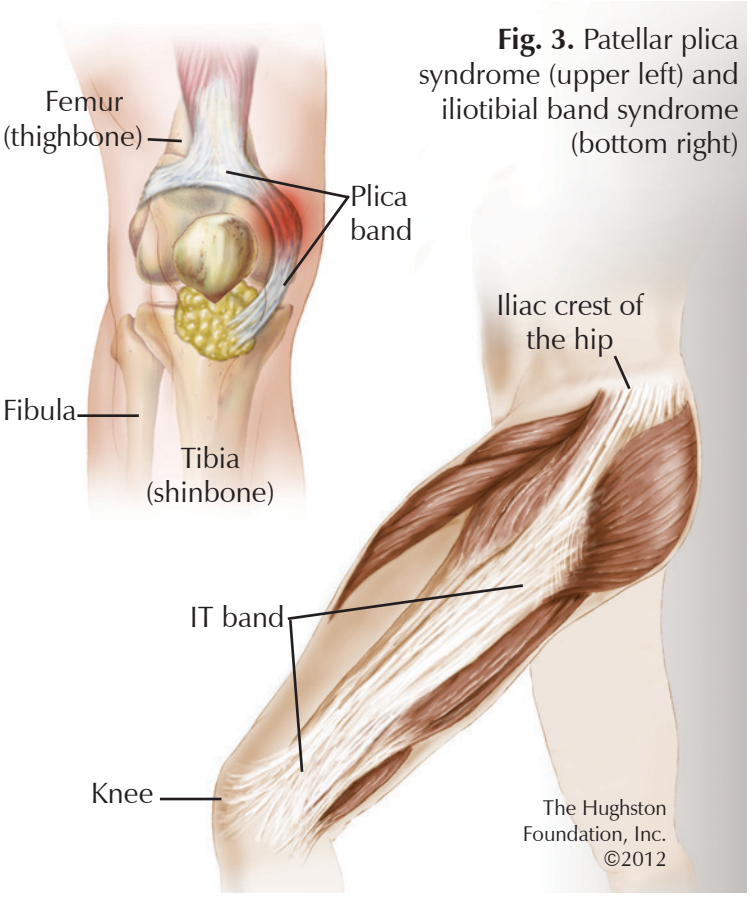
Bike fit. Improper bicycle fit can cause injury to a cyclist's knee. The seat position is the main culprit. If the seat is too far forward or too low, it can cause increased pressure across the knee joint. High flexion angles of the knee put knee cartilage at risk for excessive shearing and compression.

Cadence. Cadence is defined as the number of times the pedal makes a 360° turn, or revolution per minute (rpm). The goal of a cyclist should be to comfortably maintain a cadence of 70 to 80 rpm. A lower cadence can cause muscle strain in the lower extremity, increasing the risk of injury. For example, going up a steep hill while set in a higher gear that forces the cyclist to use more exertion to move a short distance. A higher cadence using minimal effort to move can also result in injury because it causes eccentric activity of muscles. For this reason, selection of correct cycling gear to match the terrain is essential.

Cycling at a light pace helps to improve fitness and increase endurance. It's a valuable activity for those who do not want to put extra stress on their joints and muscles during exercise. However to avoid problems, you should get your body prepared for exercise by warming up your muscles by running in place a few minutes and then stretching them out. Don't overwork your muscles, and, at the first sign of pain, stop and rest.

Yaser El-Gazzar, MD
Columbus, Georgia

Fig. 3. Patellar plica syndrome (upper left) and iliotibial band syndrome (bottom right)



Orthopaedic Components:

WHAT MAKES A TOTAL KNEE IMPLANT?

A commonly performed procedure, knee arthroplasty, or knee replacement, allows people with debilitating osteoarthritis, or other conditions of the knee, to improve their activity levels and decrease their pain. Although some people have a partial knee replacement, total knee replacement is most common. Removal of arthritic bone in the knee was performed as early as the 1860s. In an attempt to reduce their patients' pain, surgeons used various materials, including skin, muscle, fat, and even pig bladder, to place between the arthritic ends of the bones in the knee. During the 1970s, a replacement resembling those used today was developed. Current designs of total knee implants are constantly being changed and improved, but there are some basic concepts that apply to total knee replacement components.

Four basic components (**Fig.**) are used in a total knee replacement: 1) the femoral (thighbone) component, 2) the tibial (shinbone) component, 3) a plastic portion between the femur and tibia, and 4) the patellar (kneecap) component. During total knee arthroplasty the diseased ends of the femur and the tibia and the diseased surface of the patella are cut away. The meniscus (crescent-shaped soft tissue between the tibia and femur) is removed, as well. The medial and lateral ligaments (tissues that connect bones) are left in place to stabilize the replacement components. The end of the femur and tibia are replaced with metal parts, and a polyethylene component replaces the meniscus between them. A polyethylene component can also be used to replace the joint surface of the patella.

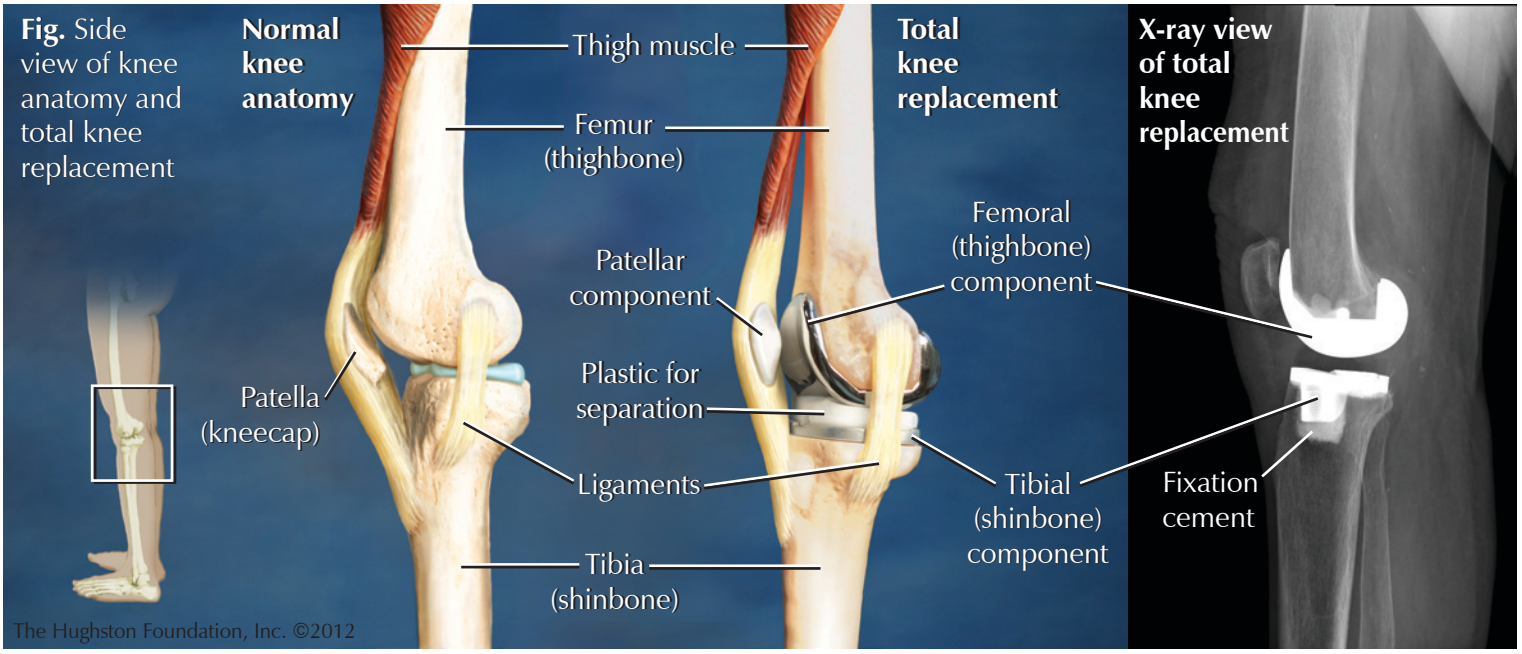
Metallic orthopaedic implants are made of stainless steel or other metal alloys. An alloy is defined as a substance that is composed of 2 or more metals fused, or dissolved, together. A cobalt-based alloy (cobalt, chromium, molybdenum) is often used in the femoral and tibial components. The cobalt-based alloy is well suited for use in joint replacement surgery, because it has good resistance to wear and corrosion. It is also biocompatible, which means it is less likely to be rejected by the body.

During surgery, the metal components must be securely fixated, or attached, to the bone. Fixation can be achieved with a press-fit design (the metal is textured to create a tight fit) or by using polymethylmethacrylate (PMMA) cement. PMMA is used like a grout to hold the metal components to the bone. The PMMA is radiopaque so the cement can be seen on x-rays, and antibiotics are often added to the cement mixture to help decrease the risk of infection.

A hard polyethylene component attaches to the tibial metal component and acts as a replacement for the meniscus. The femoral metal component rests on the plastic where it is able to rotate and allow the knee to bend and straighten. The surface of the patella can also be replaced; the diseased portion of the cartilage is removed and replaced with a polyethylene component that rests on the femoral metal and allows the kneecap to function. Altogether, these artificial components form a total knee arthroplasty.

If the weight-bearing surfaces of your knee are causing you pain, you may be a candidate for knee replacement. After considering your age and lifestyle, your surgeon will choose the components for a surgical procedure that can help you return to an active, enjoyable life.

Erin Kawasaki, DO
Columbus, Georgia



Tennis and Back Pain

Playing tennis helps to improve aerobic fitness, balance, coordination, speed, strength, motor skills, flexibility, and bone density. Although it is a relatively safe sport, musculoskeletal injuries do occur. Tennis elbow and shoulder strains are probably the most well recognized injuries; however, back pain is a frequently occurring symptom among tennis players, as well.

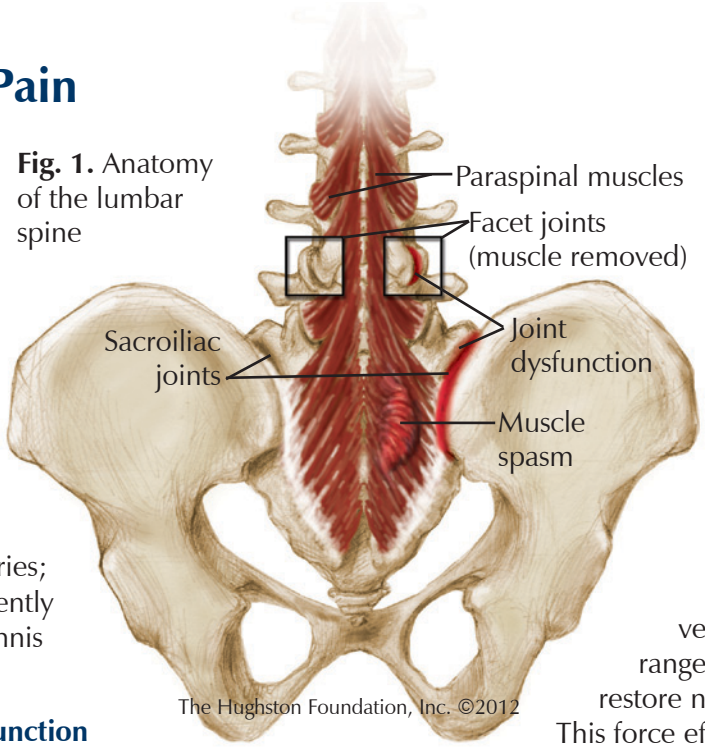


Fig. 1. Anatomy of the lumbar spine

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Muscle strain and joint dysfunction

Lumbar paraspinal muscle strain is the most common cause of back pain among tennis players. Muscle fatigue, poor physical conditioning, and failure to adequately warm-up before playing can lead to muscle spasm. This involuntary muscular contraction, which feels like a knot or tightness in the lower back, leads to stiffness and loss of motion and may be the first sign of injury. These spasms often have a protective role in preventing further injury. The overlying paraspinal muscles of the back and underlying facet and sacroiliac joints (**Fig. 1**) have a unique feedback mechanism, the *arthrokinetic reflex*, which is controlled by nerves that sense position and transmit pain. An injury to the overlying muscle affects the underlying joints, and joint dysfunction affects the overlying muscles. Minor muscle sprains or strains are self limiting, but persistent back spasms can be a sign of a related injury to a joint, ligament, or intervertebral disc.

Playing tennis requires complex motions, such as twisting, bending, turning, squatting, or jumping, that are necessary for serving, reaching for overhead or low shots, and forehand and backhand returns. When the arthrokinetic reflex is balanced, the lower back muscles and joints work together smoothly and painlessly (**Fig. 2**). A sudden muscle strain or abnormal stress to a facet or sacroiliac joint or cumulative injuries over time can disrupt this balance and lead to pain.

Prevention and treatment of muscle strains

Professional tennis players know the importance of a routine of muscle stretching and warming up before competition. Paraspinal muscle and hamstring stretching are important preventive measures. In addition to muscle stretching, a routine of quadriceps and calf muscle strengthening exercises should be included in your training program. Minor muscle strains usually respond to ice, heat, and short-term use of anti-inflammatory medication. Most athletic trainers are quite capable of treating these injuries in tennis players.

Treatment of facet or sacroiliac joint dysfunction

If the injury involves a dysfunctional lumbar facet or sacroiliac joint, an evaluation by a physical therapist with training in manual therapy is needed. With careful physical examination, a manual therapist can isolate the level of injury and direct low-velocity force within the physiologic range of motion of the specific joint to restore normal joint motion and function. This force effectively moves the facet passed the arthrokinetic reflex restoring the normal function in the facet, which allows the inflammation to subside and the healing process to begin. Recovery from joint dysfunction is aided by specific range of motion exercises to maintain full joint function as well as exercises to correct posture. Most tennis players are back on the court within 2 weeks. Low back pain and dysfunction that persists in spite of these measures should be evaluated by an orthopaedic spine specialist.

Tennis players who stay in good physical condition and know the importance of maintaining muscle flexibility and strength through a routine of muscle stretching and regular exercise will be able to resolve strains of their paraspinal muscles, prevent facet or sacroiliac joint dysfunction, and spend more time on the court.

Tom Boers, PT
Columbus, Georgia

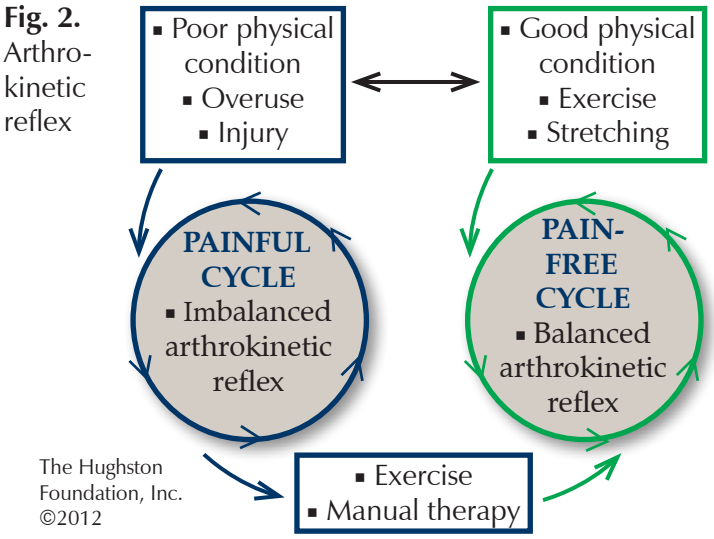

Fig. 2. Arthrokinetic reflex

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Glucosamine and Chondroitin

CAN SUPPLEMENTS HELP YOUR KNEE PAIN?

Glucosamine and chondroitin are naturally occurring compounds found in healthy cartilage. At the cellular level, glucosamine is an amino sugar that the body supplies to cartilage and other connective tissues. Chondroitin sulfate is a complex carbohydrate that helps the cartilage retain water. The breakdown of the cartilage through wear and tear or through traumatic injury can lead to the development of arthritis. Often, patients with knee arthritis use glucosamine and chondroitin supplements to help relieve joint pain.

Commercially available glucosamine and chondroitin are produced from shellfish, fungi, or cartilaginous animal byproducts. They represent a class of supplements called nutraceuticals, or food supplements, that are not regulated by the FDA. This means that neither the composition nor purity of the supplement is regulated beyond the scrutiny of the producing company. There are few side effects associated with the supplements; therefore, the lack of FDA regulation largely means that the purity or promised quantity of supplement may vary between producers.

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What does the research reveal?

Several recent studies show that the glucosamine sulfate preparations are not significantly better than placebo, but are comparable to long-term use of Celebrex (a type of nonsteroidal anti-inflammatory medication) for the management of knee pain in osteoarthritis. The supplements do not show prevention of arthritis progression. The studies do indicate that the supplements may have some benefit in advanced or severe arthritis and that glucosamine sulfate alone can be more beneficial than glucosamine hydrochloride, chondroitin sulfate, or a combination of them. Despite the findings, the American Academy of Orthopaedic Surgeons does not feel that sufficient evidence exists to recommend prescribing the supplements for arthritis pain. This paints a confusing picture for patients, especially since some patients feel they receive pain relief from the use of the products.

How can you use this information?

Given the low risk of side effects, it is reasonable for you to use over-the-counter glucosamine sulfate supplements along with exercise and a healthy diet to control weight if you find it helpful in reducing your arthritis pain. However, you must understand that the current literature does not indicate that the supplements prevent arthritis progression. If you want to try glucosamine sulfate supplements, first discuss the treatment with your physician, especially if you are planning to have surgery because glucosamine can interact with anticoagulants (blood clotting medications). Your doctor can suggest using the supplements with other techniques, such as taking anti-inflammatory medication, exercise, physical therapy, and weight loss, to manage your arthritis.

Michael J. Maughon, Jr., MD
Columbus, Georgia

New Heat Policies - Summer 2012

The Georgia High School Association revised their policies and guidelines regarding heat, humidity, and hydration at their March Executive Committee meeting. Because deaths caused by heat illness have been on the rise, the changes were suggested out of concern for high school athletes. The revised policy is meant to protect athletes and to provide specific guidelines for coaches, athletic trainers, and school administrators to follow. Head coaches are required to keep a signed copy of the new policy on file and it must be given to the athlete's parents or guardians so that they are aware of the new guidelines. Schools that violate the heat policies can be fined.

Georgia High School Association – Revised Practice Policy for Heat and Humidity*

Schools must follow the statewide policy for conducting practices and voluntary conditioning workouts in all sports during times of extremely high heat or humidity, or both. The policy will be signed by head coaches at the beginning of each season and distributed to all players and their parents or guardians. The policy shall follow modified guidelines of the American College of Sports Medicine in regard to:

- Scheduling of practices at various heat/humidity levels;
- Ratio of workout time to time allotted for rest and hydration at various heat/humidity levels; and
- Heat/humidity level that will result in practice being terminated.

A scientifically approved instrument that measures Wet Bulb Globe Temperature (WBGT) reading must be used at each practice to ensure that the written policy is being followed properly. Once the WBGT reading is obtained, the "Activity Guidelines and Reset Break Guidelines" can be followed.

Guidelines for hydration and rest breaks

- Rest time should involve both unlimited hydration intake (water or electrolyte drinks) and rest without any activity involved

- For football, helmets should be removed during rest time
- The site of the rest time should be a "cooling zone" and not in direct sunlight
- When the WBGT reading is over 86:
  - ice towels and spray bottles filled with ice water should be available at the "cooling zone" to aid the cooling process
  - cold immersion tubs must be available for practices for the benefit of any player showing early signs of heat illness.

Definitions

Practice – the period of time that a participant engages in a coach-supervised, school-approved sport or conditioning-related activity. Practices are timed from the time the players report to the field until they leave the field.

Walk-through – this period of time shall last no more than 1 hour, is not considered to be a part of the practice time regulation, and may not involve conditioning or weight-room activities. Players may not wear protective equipment.

Football practice usually kicks off during the heat-intense month of August; therefore, the GHSA revised portions of their football policies to meet the new standards for heat and humidity. The changes are summarized below:

- Football practices can start 5 weekdays prior to August 1st with helmet only practices (July 25th this year).
- Full practices (including two-a-days) can start August 1st.
- A day with 2 practices must be followed by a day with 1 or no practices.
- Practice can be no longer than 3 hours (shorter depending on the WBGT) or combined 5 hours for a two-a-day.
- Two-a-day practices will have to have a minimum 3-hour non-activity break between practices.
- The heat scale will be based on the Wet Bulb Globe Temperature (not the wet bulb temperature).
- Cold tubs will be required above a set WBGT.

The GHSA has changed to the wet bulb globe temperature (WBGT) rather than using the wet bulb temperature because they feel that the WBGT provides a better reading as well as a better gauge of the heat and humidity. WBGT is a composite temperature used to estimate the integrated effect of temperature, humidity, wind, and solar radiation on humans. Wet-bulb temperature (WBT) is measured using a thermometer that has its bulb wrapped in cloth—called a sock—that is kept wet with distilled water via wicking action. The dry bulb temperature (DBT) is recorded from a standard mercury thermometer. The globe temperature (GT) measures the sun's radiation and has a black metal casting around the end of the thermometer. Once the 3 readings have been taken, the readings can be plugged into the following formula to calculate the WBGT: WBGT = (0.1 x DBT) + (0.7 x WBT) + (GT x 0.2).

The GHSA is compiling a list of approved devices that measure the WBGT. Once the list has been completed it will be posted on the GHSA website at www.GHSA.net.

The revisions to the GHSA heat-related policies are meant to keep athletes safe. Georgia temperatures and humidity can be tortuous during the summer months, but other parts of the country can experience extreme heat as well. Adoption of similar practice policies for heat and humidity can be helpful to athletes everywhere.

Lindsey Sharpe, ATC
Columbus, Georgia

*Policy reprinted with permission from the Georgia High School Association.

Further Reading

GHSA (2012). GHSA Newsletter. April 2012. Retrieved April 15, 2012 from http://www.ghsa.net/files/documents/newsletter/NewsApril12.pdf.

GHSA (2012). Minutes from the GHSA executive committee meeting – March 19, 2012. Retrieved April 15, 2012 from http://www.ghsa.net/files/documents/executive-committee/Minutes_19Mar2012.pdf.

Activity and Rest Break Guidelines*	
WBGT Reading	
Under 82.0	Normal activities - during working out provide at least 3 separate rest breaks each hour with a minimum duration of 3 minutes each during workout.
82.0 – 86.9	Use discretion for intense or prolonged exercise; watch at-risk players carefully; provide at least 3 separate rest breaks each hour with a minimum of 4 minutes duration each.
87.0 – 89.9	Maximum practice time is 2 hours. For Football: players restricted to helmet, shoulder pads, and shorts during practice. All protective equipment must be removed for conditioning activities. For all sports: provide at least 4 separate rest breaks each hour with a minimum of 4 minutes each.
90.0 – 92.0	Maximum length of practice is 1 hour, no protective equipment may be worn during practice and there may be no conditioning activities. There must be 20 minutes of rest breaks provided during the hour of practice.
Over 92.1	No outdoor workouts; cancel exercise; delay practices until a cooler WBGT reading occurs.

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P.O. Box 9517
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JACK HUGHSTON MEMORIAL HOSPITAL
4401 River Chase Drive
Phenix City, AL 36867
Phone: 334-732-3000
Fax: 334-732-3020

www.hughston.com