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Weak in the Knees: A Review of Synovial Joints

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Part I – The Injury

John McKnight was a stellar athlete from a high school in McKinney, Texas. He was involved in multiple sports, constantly working out and actively practicing. During his freshman year, John fractured the head of his left tibia early in the football season. After a six-week recovery period of walking on crutches and doing light rehab, John's doctor released him to resume sports and cleared him to play for the rest of the football season.

The day after he was cleared, John bounced back and played a full football game. Curiously, instead of the left leg, John's right knee felt strained and painful during and after the game. John didn't think the pain was too bad, so he pushed through and didn't mention anything about it to his coach, parents, or doctor. John finished out football that fall and actively participated in basketball that winter and baseball in the spring despite the minor pain. John combatted the pain with icing and over-the-counter non-steroidal anti-inflammatory drugs (NSAIDs).

During the following year, when John was a sophomore, he continued playing sports without re-injury until baseball season. John missed several of the games during the first month of the season because of a bad case of the flu. After several weeks, John was mentally ready to get back on the baseball field, although his body was still drained of energy and weak from being sick.

During his morning workout the first day back, John skipped his warm-up routine, including stretches. When he squatted to do a box jump he felt a sharp pain in his right knee. He shrugged it off, thinking it was normal, and relaxed until that evening because an important game against the team's biggest rival was scheduled that night. John's team needed a big win to secure the conference title.

After getting his first base-hit of the game, he was feeling confident, and it was obvious that the crowd was happy to have him back. The next batter swung at the ball, but missed, so John took a chance stealing second base. He made it, but he was unable to stand and place pressure on his right lower extremity after sliding into the base. He tried repeatedly but couldn't walk because of an excruciating pain in his right knee. Some of his fellow players helped carry him off the field and into the dugout, where he stayed the rest of the game. That night, John iced his swollen and painful right knee and took some more NSAIDs. He went to his orthopedic doctor the next day.

Questions

1. Why was John's right knee sore following the fracture of his left tibia?

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2. What activity or activities caused the injury that led John to return to the orthopedic doctor?

3. Could John's overall health have played a part in his injury?

4. How could John have prevented his painful right knee from becoming a more serious injury?

5. What are some of the body's natural immune responses to injury that are causing John's symptoms? Explain.

6. Why would icing the knee and NSAIDs be helpful?

7. Predict what the doctor's action may be at his appointment the next day.

Part II – At the Doctor's Office

John woke up the next morning with pain and stiffness in his right knee. He slowly got out of bed and started getting ready to go to the doctor as planned, but the pain in his knee made it difficult. Anytime John moved his knee, it would catch and feel like it was locked, so he tried to keep it as straight as he could. John iced his knee and took another dose of NSAID pain reliever before heading to the doctor's office.

After arriving at the doctor's office, John explained to Dr. Pearson what had happened. "I hurt my knee when I was working out, but I thought I was fine. When I slid into second base, I felt it pop. There was some pain, but really, it felt like there was something stuck, and I couldn't fully flex or extend my knee. Since then, my knee has been so swollen and stiff. It seems to keep locking up, plus the pain has gotten worse. Now I can hardly move it." John looked miserable.

After hearing the history and examining John's knee, the doctor had a strong suspicion of what was wrong. "Well John, I think you have torn a ligament in your knee. We need to do some tests to confirm this, but you will be out of sports for the time being. Let's start with an MRI and see what's going on." Instead of an x-ray, Dr. Pearson decided to order an MRI to confirm his preliminary diagnosis. Dr. Pearson pulled some strings and was able to get the MRI scheduled right away.

Questions

1. Why do you think the doctor decided to skip the x-ray at this time? What structures or tissues are x-rays helpful in detecting for diagnostic purposes?

2. What is an MRI and what is its purpose?

3. Describe an articular (joint) capsule. What is the purpose of synovial fluid?

4. Label the following structures of a knee joint using the illustration below (Figure 1).
   A. Patella
   B. Articular cartilage
   C. Anterior cruciate ligament
   D. Posterior cruciate ligament
   E. Medial meniscus
   F. Lateral meniscus
   G. Fibular collateral ligament
   H. Tibial collateral ligament

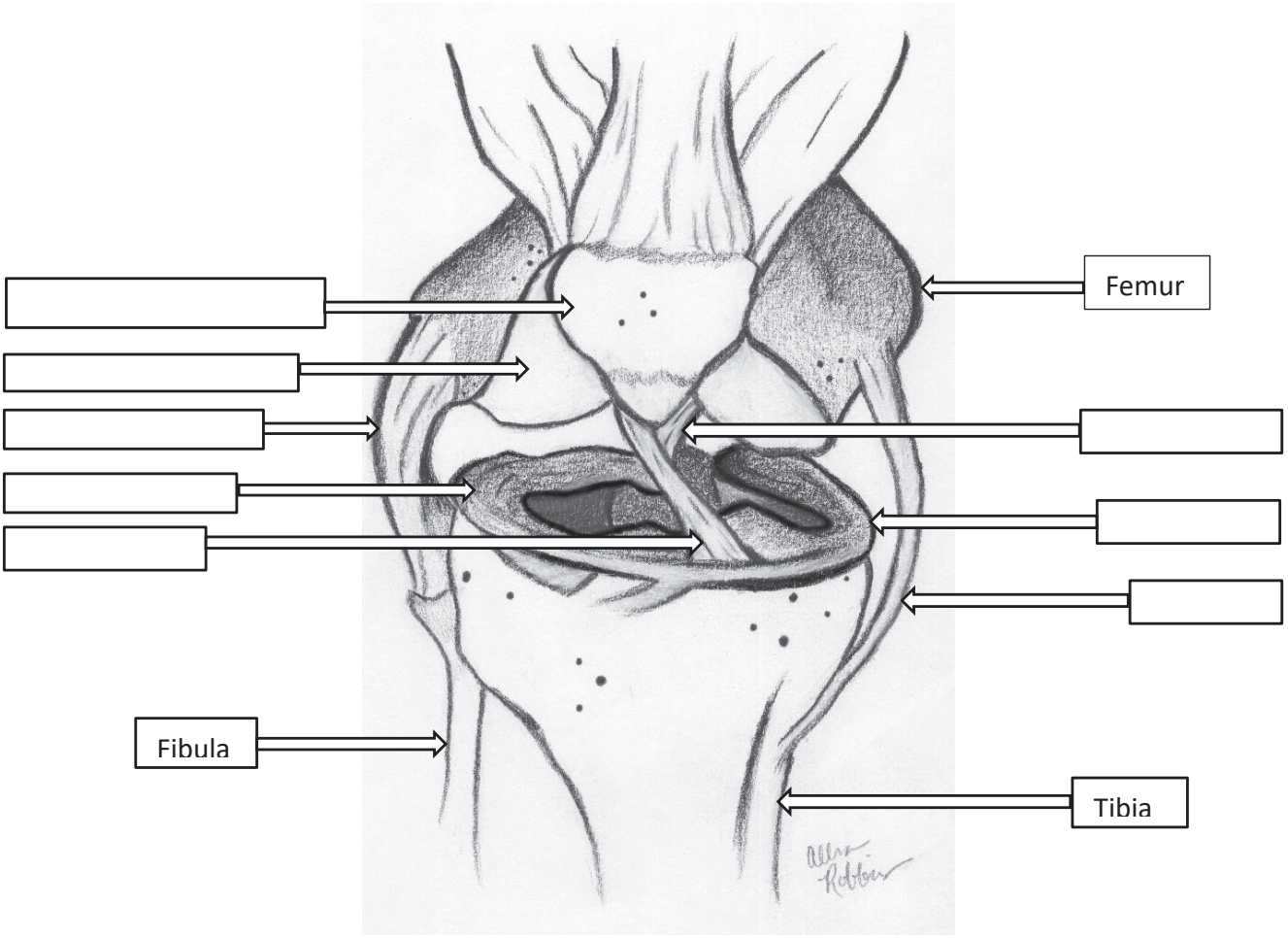

Figure 1. Illustration of knee showing major ligaments. Medical illustration courtesy of Allison Robbins (allisoncearnhart@gmail.com).

Part III – Follow Up

The next morning, John and his parents were waiting in the examination room at the doctor's office. John had just had his MRI and they were waiting on Dr. Pearson to come in and explain the MRI scans. The whole family was anxiously awaiting the results.

"Well, John, it looks like you have a torn meniscus. This is your knee," said Dr. Pearson as he showed John and his family the MRI image (Figure 2). "Do you see this white area circled on the scan?"

John carefully looked at where Dr. Pearson was pointing. "Yes, I see it."

"Well," said Dr. Pearson, "that white area isn't present in a normal knee scan; it's actually fluid leaking in through the meniscus tear. The menisci are semicircular discs of cartilage that provide a cushion between the femur and the tibia and help stabilize the knee when it's in motion. Due to your injury, the meniscus on the medial side is not currently attached, and the 'flap' is just moving around. This is what's getting stuck when you move your knee, causing the locked feeling."

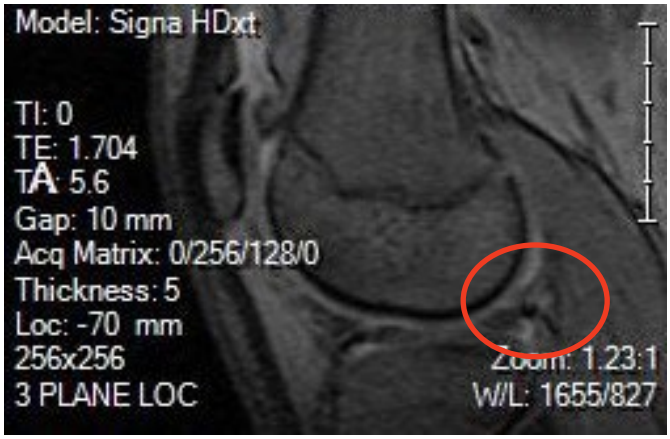

Figure 2. MRI medial view of injured knee indicating damaged meniscus.

John looked nervous and blurted, "Am I ever going to be able to play sports again?!"

Dr. Pearson explained to John and his family that surgery would be the best option to fix his knee. Dr. Pearson suggested surgical repair of the meniscus, which would provide minimal setback in ability, function, and recovery time, while also stabilizing the knee. He also warned John that he would be able to play sports again only if he allowed adequate time for repair, followed by physical therapy and strength straining before returning to competition. John sighed with relief knowing that he would be able to play sports again. John exclaimed, "I'm ready. Let's do this!" John's parents agreed, and the surgery was scheduled.

Questions

1. What are menisci and what is their function at the knee?

2. What other structures help stabilize the knee joint? How does each structure contribute to stabilizing the knee?

3. Compared to other joints, why does the knee require extra support?

4. How is a torn meniscus identified on an MRI?

5. After hearing from Dr. Pearson, what do you think is causing the locked feeling in John's knee?

Part IV – Recovery

After the surgery, John was given post-op instructions that were recommended for proper recovery. Included with the instructions, Dr. Pearson supplied John with a list of exercises to start 24 hours after surgery. The exercises, including straight leg raises, ankle pumps, and quad flexes, were intended to re-strengthen the muscles surrounding the operative knee. John was instructed to do the given exercises at least three or four times per day until his post-op visit.

Questions

1. Which muscles flex and extend the leg at the knee?

2. What is muscle atrophy? Does John need to be concerned about muscle atrophy? How can muscle atrophy be prevented?

3. Why does John need to start exercising the knee so soon?

John was also sent to a physical therapist, Dr. Freeman, who specialized in knee repairs for recovering athletes like John. The PT prescribed a six-month protocol, or "recovery period," that gradually brought the repaired knee back to normal function. Her approach started with light rehab and worked up to more difficult tasks each week.

While John was at the physical therapist's office, he met a gentleman, Mr. McGraw, who reminded him of his grandfather. They immediately began a friendship.

"Hi, Mr. McGraw! How's the knee today?" John exclaimed during a rehab visit.

"I can't complain too much. I'm happy to just be getting around, John. I'd like to avoid knee surgery," Mr. McGraw explained.

John looked concerned. Mr. McGraw was elderly and his wife had recently passed away. John knew it would be difficult for Mr. McGraw to have any type of surgery while living on his own without family around.

As they waited to be called back for treatment, John asked, "Could you tell me about your knee again, Mr. McGraw?"

"Well, I've told you all of my good football stories. I had a great time back then but didn't really think about what it would be like when I got older. All that rough play so long ago really took a toll on my knees; now I have osteoarthritis. Every time I bend my knee you can almost hear the bones crunching against each other."

Questions

4. What is arthritis? What are some symptoms of arthritis?

5. Describe osteoarthritis. How does arthritis limit movement at a joint?

6. How does rheumatoid arthritis differ from osteoarthritis?

7. What type of physical therapy activities would be beneficial for arthritis?

John sat thoughtfully and looked up to see that Dr. Freeman was standing in front of the pair and had overheard their conservation.

"Mr. McGraw is right, John. Take care of your body while you're young and it will last a lot longer. Playing strenuous sports when you're injured isn't a smart choice. I hope you will wait until you're completely healed and have been released by your doctor before you resume athletics."

Mr. McGraw added, "I'll make you a deal, John. If you keep coming to PT and wait to participate in sports until you've been cleared, I promise to attend the first athletic event that your doctor allows you to participate in and I'll be your biggest fan!"

John smiled and shook Mr. McGraw's hand. "It's a deal, Mr. McGraw."