

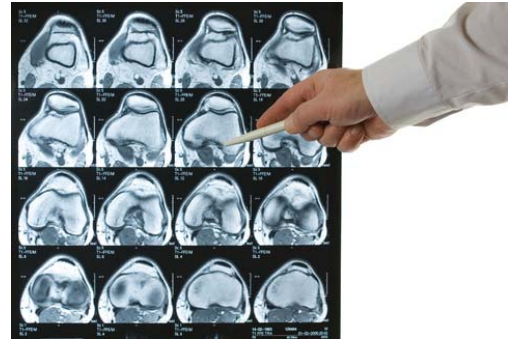
A Spill at Parsenn Bowl: Knee Injury and Recovery

by

Elaine S. Chapman

Department of Biology

Illinois College, Jacksonville, IL



Part I – The Slopes

Elaine was enjoying a pleasant day on the ski slopes at Winter Park. When she got on the lift to the top of Parsenn Bowl (12,000 ft), the weather was fine—windy, but sunny. During the 5- or 10-minute ride, the weather changed suddenly; it became a white-out, with icy surface snow, blowing snow, a very strong wind, and extremely low visibility. Many people fell as they got off the lift, including Elaine. However, she got up and joined her family members as they stood, wondering just how they were going to get down the mountain. Meanwhile, the lift closed due to the terrible conditions (50-mile-an-hour wind and a temperature of -20° F). As she adjusted her stance, Elaine somehow twisted and fell again, which resulted in external rotation of her right knee. There was no pain at the time and she thought she could get up and prepare to get down the mountain, but her knee was too unstable. While she sat on the icy surface, her husband notified the lift operator to call the Ski Patrol. In about 20 minutes they arrived and put her on a sled, which they skied down the slope; when they reached the Ski Patrol headquarters, they transferred the sled to a snowmobile and promptly got her down the mountain and into the emergency room.

Questions

1. What mechanisms did Elaine's body employ to maintain homeostasis?
 - a. Where are the sensors for cold?
 - b. Where is the "thermostat" of the body located?
 - c. What is the effector (i.e., what tissues are involved) for the blood vessel constriction? For the shivering?
2. What areas of the body would be the most vulnerable to frostbite?

Part II –The Emergency Room

Paramedic and Ski Patrol member Mondo brought Elaine into the emergency room and began to examine her. He quickly removed her ski boots, checked the dorsalis pedis pulse, and told her to take off her parka; an assistant brought blankets and hot chocolate. At that time Elaine was not experiencing intense pain, but she was shivering uncontrollably. The pain was relatively localized to the medial surface of her right knee, and the knee was already considerably swollen. He indicated that there was probably damage to a ligament or two. Elaine was then moved to the Mile-High Clinic for further evaluation.

Questions

1. Why was Elaine instructed to remove her parka?
2. Why was she shivering?
3. Why was the knee swollen?
4. Where would the dorsalis pedis pulse be taken? Why?
5. How do the bones that comprise the knee joint fit together?
6. What structures are associated with the medial surface of the knee?

Part III –The Mile-High Clinic

In the clinic, Elaine was examined by a nurse practitioner and sent for an X-ray, which showed swelling but no fracture. The nurse practitioner performed a Lachman test on Elaine's knee; the results were so positive that they could be seen across the room. In fact, an orthopedic surgery resident was brought in so that he could feel and see firsthand the contrast between a positive Lachman test (on her right knee) and a negative test (on the left, uninjured knee). A positive Lachman is essentially diagnostic of complete rupture of the anterior cruciate ligament (ACL). Further examination confirmed injury to the medial collateral ligament. Elaine was instructed to see an orthopedist at home and given crutches and a brace as well as some pain medication because her knee was not stable enough to walk and was beginning to hurt. In addition, she was told to keep her leg elevated and put ice on her knee—and definitely *not* use the hot tub.

Questions

1. What type of injuries would be identified most clearly on an X-Ray? Why?
2. What is a positive Lachman maneuver/test?
3. What is the purpose of the leg elevation and ice? (Wasn't she already high enough and cold enough?)
4. Why was she instructed *not* to use the hot tub?

Part IV –Seeing the Orthopedic Surgeon #1

The day after she arrived home, Elaine saw Dr. Scott. He ordered an MRI, which confirmed the injury. He suggested that she consider reconstructive surgery on her knee. While some patients elect to avoid surgery, they are at much higher risk of developing osteoarthritis earlier, and the instability of their knee makes them more likely to fall again. Thirty years ago most surgeons would not have suggested surgery for this injury, particularly in someone aged 55, and the surgical techniques were not as successful as they are now. Because Elaine was a fairly active individual prior to the accident, Dr. Scott encouraged her to have reconstruction of the anterior cruciate ligament, and he referred her to another orthopedic surgeon who did that surgery on a routine basis.

Questions

1. Why did Dr. Scott order an MRI?
2. What difference does age make in terms of the healing process?
3. What is osteoarthritis?

Part V – Seeing the Orthopedic Surgeon #2

After viewing the MRI and talking with Elaine, Dr. Leutz strongly advised her to have reconstructive surgery on the ACL and to use conservative therapy on the partially torn medial collateral ligament. First, though, he wanted her to “pre-hab”—that is, take physical therapy for several weeks—in order to have the knee and leg in the best possible shape before the surgery. She was also instructed to use a more substantial brace. Dr. Leutz described the procedure: either a cadaver tendon OR the middle third of her patellar tendon would be removed and used to replace the ACL, which would be removed. Elaine opted to use her own tendon.

Five weeks later, Elaine went in for surgery. She was given a drug used for conscious sedation as well as a general anesthetic. Through the arthroscope the surgeon noted significant injury to both the medial and lateral menisci, which he repaired with sutures and screws. The pieces of the torn ACL were removed. A superficial incision was made in the midline of her right knee and a piece of patellar tendon was removed, along with the attaching small pieces of bone to use for the grafting procedure. Unfortunately, when the piece of patellar bone was chiseled out, the patella itself fractured. The fracture was repaired with metal screws, the incision was closed, and Elaine was discharged from the hospital.

Questions

1. What are the primary movements of the knee joint?
2. What muscle groups are the most important in flexion and extension of the knee?
3. What happens to muscle and bone tissue when they are not used?
4. Why could a tendon be used to replace a ligament? *Hint:* think histology.
5. Consider the overall structure of the knee joint. (You may wish to draw a picture or label a diagram.) What type of membrane lines the joint? What is its function? Was it cut in any way during the surgery?
6. Of the structures injured (patella, MCL, ACL, menisci), which will heal the fastest? Why?
7. *Every* incision will form some sort of scar. What is the term for *scarring of a tissue*? What cell type is most important for scar formation?



Part VI – Resolution

Physical therapy began two days after the surgery. With the aid of crutches, a wheelchair, and a brace, Elaine was able to return to work in about ten days. She continued the physical therapy at the rehab clinic and on her own for six months. With the assistance of a titanium brace, she was able to play tennis nine months after the surgery. One year following the injury she went skiing again ... but did not venture up to Parsenn Bowl.

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