Let's explore *sport injuries*....

CHAPTER 8

Out of Harm's Way: Sport Injuries

After completing this chapter you should be able to:

- identify the factors associated with injury prevention;
- describe the common musculoskeletal injuries;
- demonstrate an understanding of the implications of various chronic and acute injuries and how to treat them.

The human body is designed to perform a wide variety of simple and complex movements and skills. Clearly, this ability relies on all its parts working together in harmony. An injury to one body part can disrupt the harmony of the entire body. Fortunately, many injuries are preventable.

With more people today participating in sport and physical activity for health, fitness, and fun, avoiding injury is a notable concern. Many people ignore the warnings and risks that accompany certain activities, believing that nothing can possibly happen to them. Even the most careful physically active person can experience a mishap, but following some specific guidelines can greatly decrease your risk of sustaining an injury. Whether you make a concerted effort to improve your skills and technique when exercising, recognize the hazards that exist around you, perform proper conditioning exercises, or demand safe and quality equipment, you can enjoy an enhanced level of safety and confidence in your physical pursuits. You must take responsibility for your own actions by making appropriate decisions that reflect your safety and personal health (Figure 8.1).

Despite our efforts to take all of the necessary precautions, all dangers can never be completely eliminated; accidents do happen and injuries do occur. While most injuries are minor and not life-threatening, knowing what to do if an injury occurs helps you deal with the situation quickly and correctly. An injury that is not cared for properly can easily escalate into a chronic problem that may plague your efforts to lead an active life.

Figure 8.1 Staying fit and active throughout your life requires attention to conditioning, healthy lifestyle choices, and safety.

Biomechanical Principles of Injury

The human body is made up of tissues or groups of cells that work together to perform a particular function. The four basic types of tissue are **epithelial** (e.g., skin), **muscle**, **connective** (e.g., tendons, bones, and ligaments), and **nervous**. Each type of tissue possesses unique mechanical characteristics. For example, bones are strong and stiff, whereas tendons are flexible so that joints can be mobile.

To best understand the biomechanical characteristics of tissue we examine its behaviour under **physical load** (see box *Forces Acting on Tissue*). Under load a tissue experiences **deformation**. This change in shape phenomenon can be visualized in the load–deformation curve in Figure 8.2.

Did You Know?

When developing a prosthesis for human parts, such as a hip joint, biomechanical engineers ensure that the prosthesis can handle loads as well as or better than the human tissue it will be replacing.

Characteristics of the Load–Deformation Curve

- Loads occurring in the elastic region do not cause permanent damage.
- Permanent deformation will occur if loads exceed the yield-level point.
- The area under the entire curve represents the strength of the material in terms of stored energy.
- The slope of the curve in the elastic region indicates the stiffness of the material. Stiffness is the resistance to deformation, where the greater the slope of the curve, the greater the stiffness of the structure.

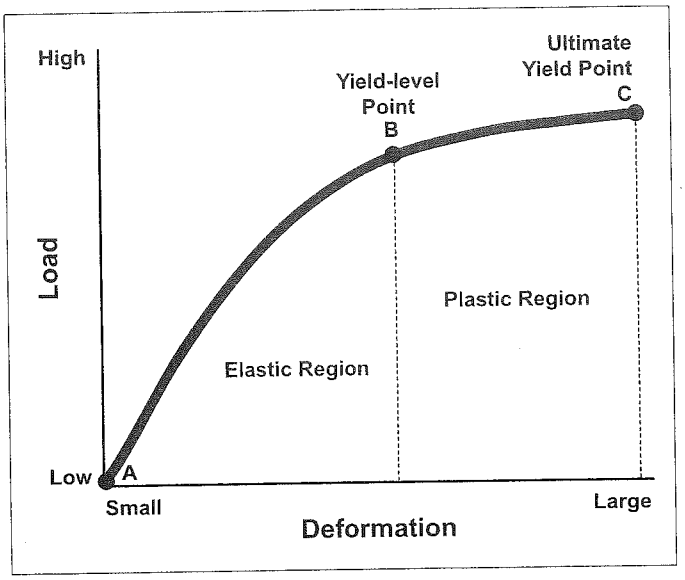


Figure 8.2 Load–deformation curve of a bone.

The A-B segment of the curve represents the **elastic region** of the tissue structure. Elasticity is the capacity of a tissue to return to its original shape after a load is removed. For example, when you push your finger into your thigh the skin and the muscle underneath your finger become depressed. When pressure is removed the tissues return to their original shape.

Point B on the curve (**yield-level point**) signals the **elastic limit** of the tissue, where the **plastic region** begins. In this region increased loads cause permanent tissue deformation, resulting in micro-failure or injury to the tissue. Sprains and strains are good examples of such injuries. If the load continues to increase to the **ultimate yield point** (point C on the curve), **ultimate failure** of the tissue eventually occurs: a bone fracture or torn ligament. At this point the tissue becomes completely unresponsive to loads.

Injury Treatment and Rehabilitation

Treatment and rehabilitation are two directly linked aspects of recovery. During **treatment**, a patient receives care by a health care professional.

Tissue Responses to Training

Human tissue responds to training loads or stresses by becoming stronger. When training loads are at or near a tissue's *yield-level point* (Figure 8.2, point B), cells may divide to make new cells or to make proteins such as *actin*, *myosin*, *collagen*, or *elastin* to improve the mechanical properties of the tissue under **stress**. This muscle response is called the **positive training effect**.

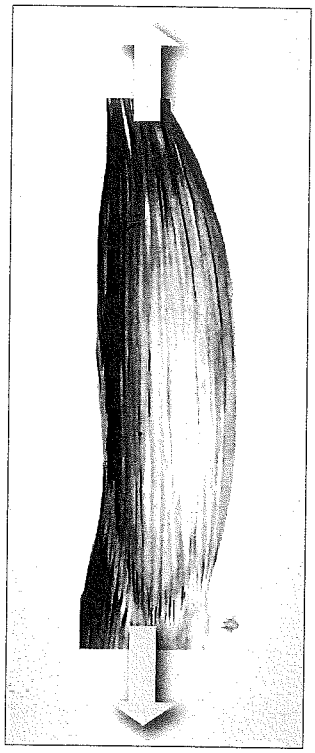
Training overloads may cause microscopic injuries in various muscle regions, leading to sore muscles. In these situations, the muscle structures are *temporarily* weakened. It is important to let them recover before another workout. Research has shown that optimal training occurs at a level of tissue stress just below the yield-level point.

Early and correct treatment promotes the healing process and improves the quality of the injured tissue(s), allowing the person to return to activity more quickly. **Rehabilitation** involves a therapist's physical restoration of the injured tissue along with the patient's active participation by following prescribed rehabilitation guidelines on his or her own.

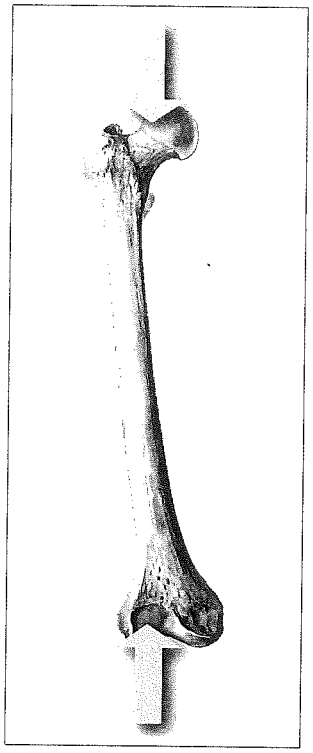
Although an individualized rehabilitation

Forces Acting on Tissue

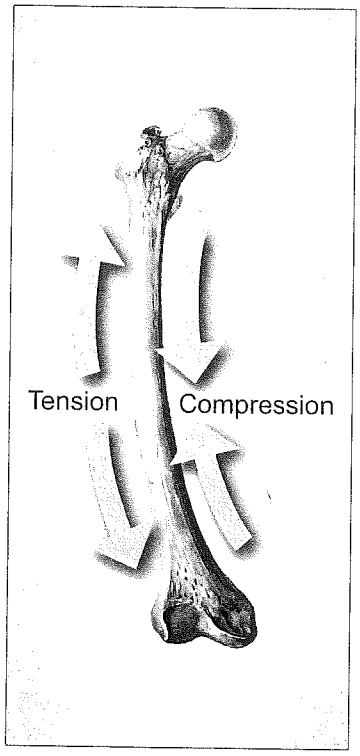
Tissue is exposed to a variety of physical stresses during physical activity. These stresses are forces and moments acting as directional loads that generate **tension** (pulling), **compression** (squeezing), **bending**, **shear**, or **torsion**.



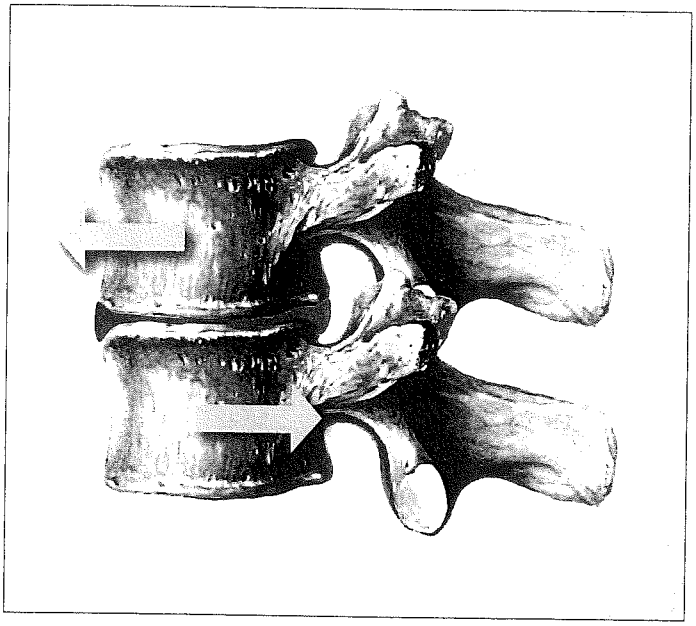
Tension



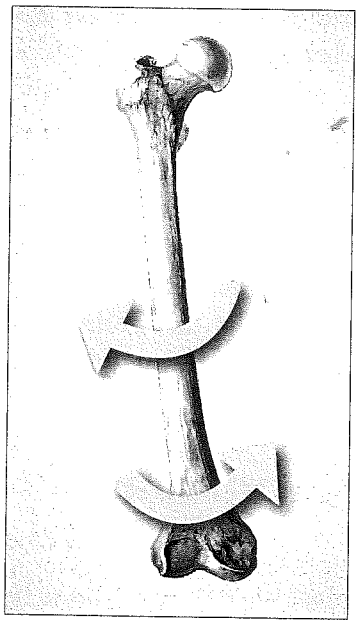
Compression



Bending



Shear



Torsion

program should be created for each athlete, knowledge of general guidelines for early treatment and rehabilitation can be useful for dealing with acute injuries in particular. Some of these guidelines will be presented in this chapter.

Healing Phases

The healing process begins immediately after injury and consists of three overlapping phases: the inflammatory response phase, the fibroblastic repair phase, and the maturation–remodeling phase (Figure 8.3).

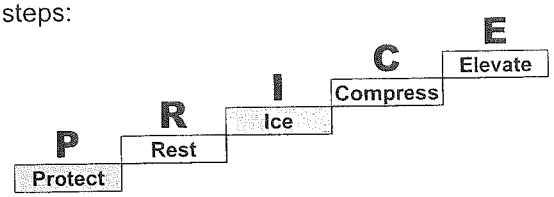
Inflammatory Response Phase

The **inflammatory response phase** sets the stage for tissue repair. Inflammation begins at the time of injury, or shortly after, and may last from two to four days. The injured area may show signs of redness, swelling, pain, increased temperature, and loss of function.

To allow healing to begin, the injury must be protected and rested. **Cryotherapy** (ice or cold water immersion for 15-20 minutes at a time) limits the amount of swelling and decreases bleeding, pain, and muscle spasms. **Compression** is applied over the ice, usually in the form of an elastic bandage. During cold water immersion a compression bandage can be wrapped around the injured area. Finally, the area is elevated above the level of the heart to encourage the return of venous blood to the heart, thereby helping to decrease acute swelling and bleeding.

Follow the PRICE rule!

When dealing with an injury, follow these simple steps:



Fibroblastic Repair Phase

The **fibroblastic repair phase** leads to scar formation and repair of the injured tissue. It begins within a few hours of injury, and may last as long as four to six weeks. A delicate connective tissue called **granulation tissue** forms to fill the gaps in the injured area. Fibroblasts produce **collagen fibres**, which are deposited randomly throughout the forming scar. In this second phase, many of the signs and symptoms seen in the inflammatory response subside.

During the fibroblastic repair phase, it is important to introduce controlled rehab-specific exercises that are designed to restore normal range of motion and strength to the injured tissue, as well as stressing the tissue to promote optimal tissue response (see box *Tissue Responses to Training*). Manual massage therapy and ultrasound help break down scar tissue. Protective taping or a brace is often used during this phase of rehabilitation.

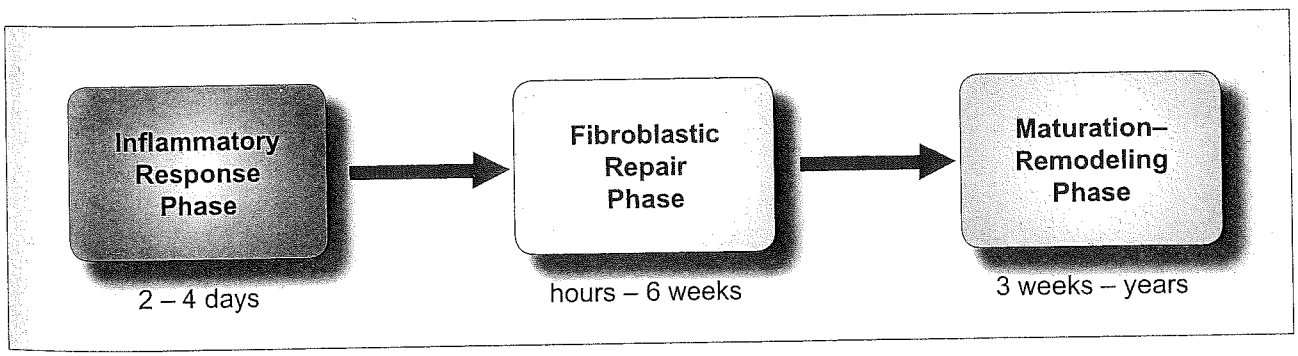


Figure 8.3 The three phases of the healing process.

Maturation–Remodeling Phase

The **maturation–remodeling phase** is a long-term process of remodeling or realigning the scar tissue. It begins about three weeks after injury and may continue for as long as several years. Stretching and strengthening become more aggressive in this phase because the goal is to organize the scar tissue along the lines of tensile stress. Sport-specific skills and activities are usually included in rehabilitation.

Pain: Nature's Warning System

Pain is nature's way of telling us something is wrong. However, many athletes ignore pain altogether. Professional athletes in particular believe that a little pain is natural, and taking a few days off to nurse an injury makes you weak and vulnerable. As a result, they choose to mask the pain with medication, which allows them to play through an injury. While the pain may subside, the problem remains unaddressed (Figure 8.4). Continued participation will push injured tissues closer to ultimate failure, resulting in a need for surgical repair. Other serious consequences of using medication to mask pain include addiction and gastrointestinal complications.

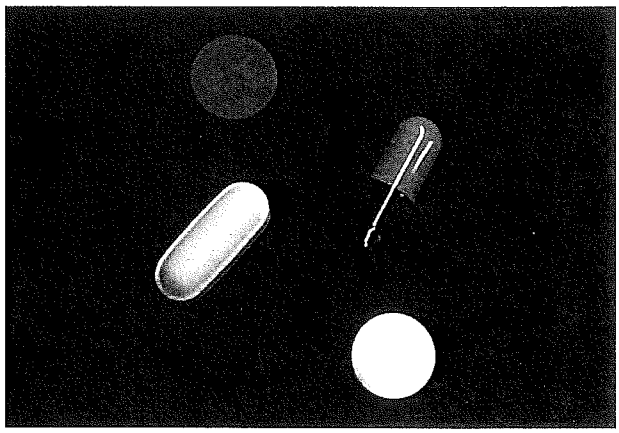


Figure 8.4 Pain medication helps reduce discomfort, but fails to address the cause of the problem.

Having said that, the temporary use of certain medications to decrease pain and inflammation may be helpful and appropriate. One should always consult a physician prior to using any medication or supplement.

How long an athlete should rest an injury depends on the type and extent of the injury, and also varies among individuals. Pain is one of the most important indicators of when it is best to resume play. We all feel it, we all know when it is present, and we all know when it has subsided. If it is painful to walk on a sprained ankle, whether one day after the injury or weeks later, it is simply too early to resume all-out activities. Once pain has subsided, training and competing may be introduced with caution. The load placed on an injured structure should increase gradually. Overloading an injured area, or coming back too early, can set you back longer than the original injury, and an acute injury may eventually become a chronic problem.

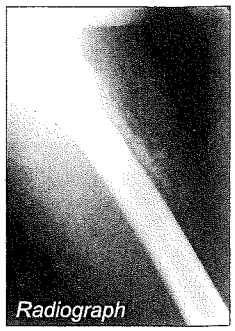
Soft Tissue Injuries

Contusions

When a compression force crushes tissue, a **contusion** results. Commonly called a bruise, symptoms include discoloration and swelling. What some athletes call a "charleyhorse" is a contusion injury, often to the quadriceps muscle group on the front of the thigh. While most

Myositis Ossificans

In a severe contusion, abnormal bone formation may occur. This is called **myositis ossificans**. The most common sites are the anterior and lateral thigh. A 2- to 4-cm mass is often palpable. Referral to a medical doctor is needed.



Management of a Quadriceps Contusion

Acute Phase (first 24 to 48 hours)

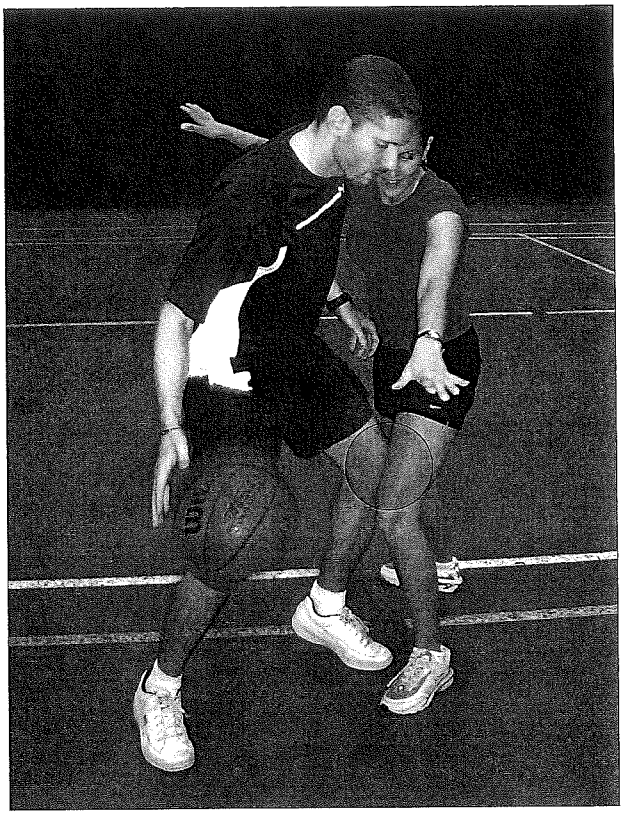
- Apply ice and compression with knee flexed at 120 degrees for 20 minutes each hour for a minimum of 4 hours.
- Begin pain-free passive or active range-of-motion exercises.

Subacute Phase (2 to 5 days)

- Continue with ice and compression.
- Continue active range-of-motion exercises.
- Begin partial weight-bearing activities.

Full Weight-bearing Phase

- Continue with ice and compression.
- Range of motion should be full.
- Slowly return to previous activities and use protective padding to prevent reinjury.
- If there is still pain seek medical attention.



These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

contusions are minor injuries, they can be serious and even life-threatening if the tissue involved is a vital organ such as the brain or kidneys.

Strains and Sprains

A **strain** occurs when muscle or tendon tissue is stretched or torn. A **sprain** results when a ligament or the joint capsule is stretched or torn, often from twisting movements or impacts that force the affected joints beyond their normal limits. Sprains and strains are classified into three grades based on the amount of damage to the tissues and the resulting pain and loss of function (Table 8.1).

Grade three sprains and strains result in complete rupture of the tissue and often require surgery. An example is an **anterior cruciate ligament tear**. The anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) crisscross the knee joint and give the knee stability. Of the two, the ACL is weaker and more likely to tear, often when changing directions rapidly or slowing down after running or landing from a jump as in basketball. A loud popping noise often accompanies an ACL tear, which is very painful. The knee joint gives out and swells very rapidly.

Common Strains

Common muscles strained in the lower extremities include the adductors (pulled "groin"), quadriceps, hamstrings, and hip flexors (iliopsoas). In the upper extremities, muscles of the rotator cuff, which help stabilize the shoulder joint, are often vulnerable to strains.

Hamstring Strains The hamstrings are the most frequently strained muscles in the body. The main mechanism of injury is rapid contraction of the hamstring muscles in a lengthened position. Most typically this occurs during sprinting or running (Figure 8.5).

Weak hamstring muscles compared with

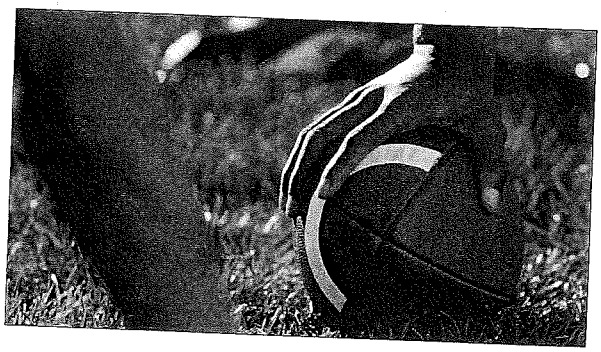
Table 8.1 Grades of strains and sprains.

Grade		Strain	Sprain
1st	Description	A few muscle fibres have been stretched or torn	Ligament has been slightly stretched or torn
	Pain	Minor pain during isometric and passive movements	Minor pain during passive movements
	Range of motion	Decreased	
	Swelling	Minor	
	Weakness	Minor	
	Disability	Little or no loss of function	
2nd	Description	More muscle fibres have been torn	Ligament has been moderately stretched or torn
	Pain	Moderate pain during isometric and passive movements	Moderate pain during passive movements
	Range of motion	Decreased	
	Swelling	Moderate	
	Weakness	Moderate	
	Disability	Moderate loss of function	
3rd	Description	Muscle is completely torn	Ligament is completely torn
	Pain	No pain during isometric and passive movements*	
	Range of motion	May increase or decrease depending on swelling	
	Swelling	Major	
	Weakness	Major	
	Disability	Major	

* *When you completely tear a muscle, tendon, or ligament, the ability to feel pain in those structures is completely lost.*

Artificial Turf vs. Natural Turf

There is much debate about whether artificial playing surfaces are more dangerous than natural playing surfaces. Artificial surfaces provide greater friction, enabling athletes to run faster and change directions more quickly. However, these conditions also increase the loads placed on muscles, tendons, and ligaments, increasing the likelihood of sustaining a strain or sprain. Therefore, a trade-off exists between performance and potential for injury on artificial surfaces.



Management of an ACL Injury

Phase 1

- PRICE
- Range-of-motion exercises within pain-free limits
- Isometric exercises for quads, hamstrings, and hip adductors
- Cardiovascular exercise

Phase 2

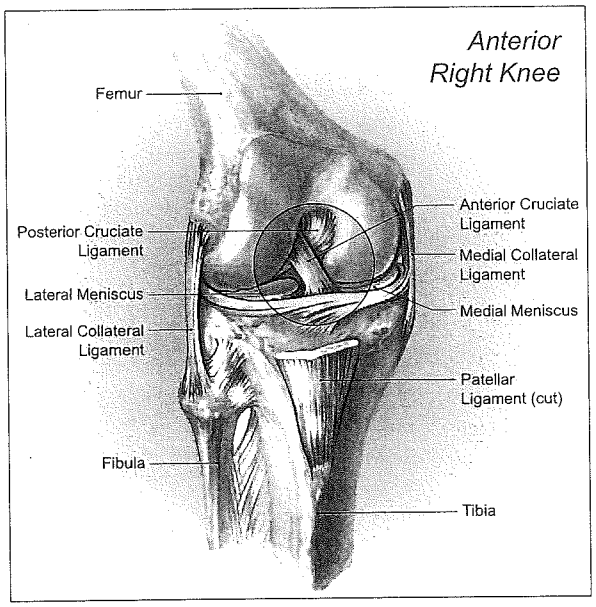
- Continued range-of-motion exercises
- Unilateral balance activities
- Slow, controlled balance activities (using a wobble board)
- Slow, controlled calf raises and straight leg raises
- Cardiovascular exercise

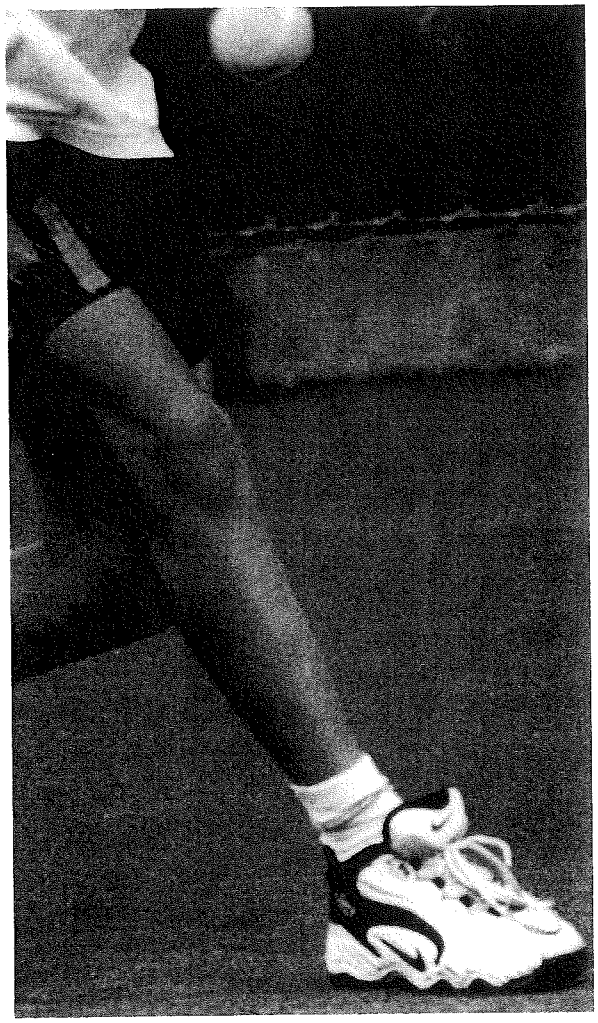
Phase 3

- Maintain range of motion
- Functional strengthening exercises (squats, leg presses, lunges)
- Cardiovascular exercise
- Continued balance activities

Phase 4

- All the activities of Phase 3, with increased sport-specific activities, such as running (circles, cross-over steps) and jumping drills (hopping, bounding, skipping)





Surgery is often needed to repair a torn ACL. Your doctor replaces the damaged ACL with strong, healthy tissue usually taken from another area near your knee. Most commonly, a portion of the patellar ligament or hamstring is used. Your doctor threads the tissue through the inside of your knee joint and secures the ends to your femur and tibia.

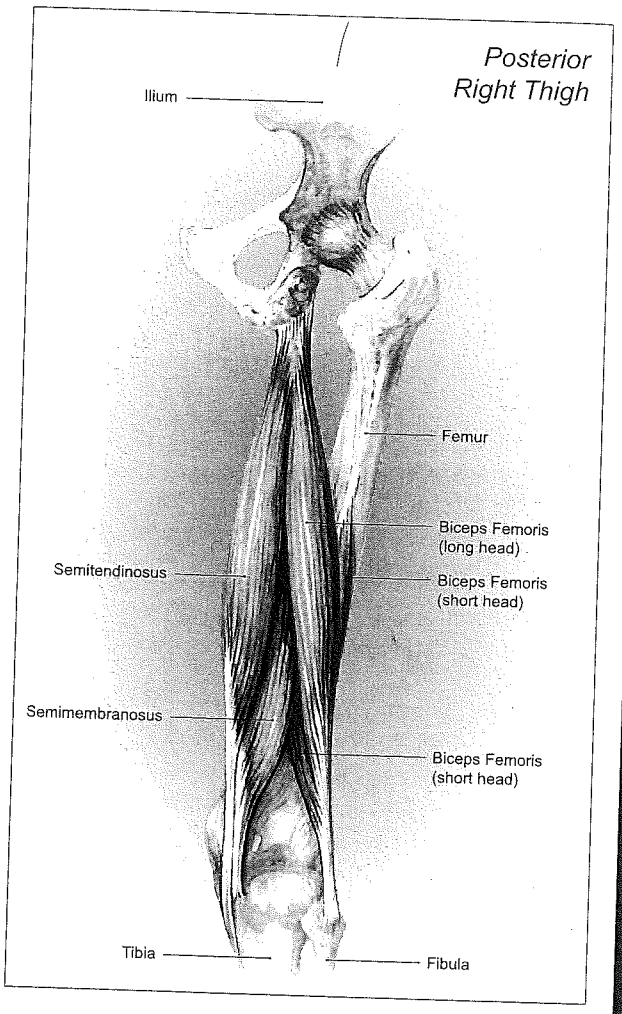
After ACL surgery, rehabilitation exercises will gradually return your knee to maximal flexibility and stability. Building strength in the muscles around the knee joint (hamstrings, quadriceps, and calf) is important to stabilize the joint. Initially, a brace is usually required to protect the joint after surgery, but with successful rehabilitation knee braces are slowly weaned off.

These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

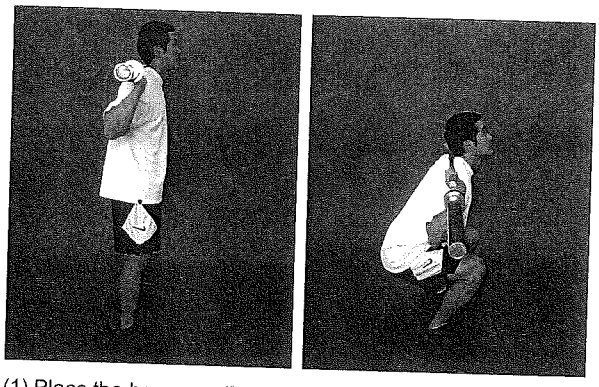
Avoiding Hamstring Strains

Below is an example of a balanced leg workout designed to avoid strength imbalances in the muscles of the thigh.

Exercise	Reps x Sets
Squats	10 x 3
Lunges	10 x 3
Hamstring curls	10 x 3



SQUATS



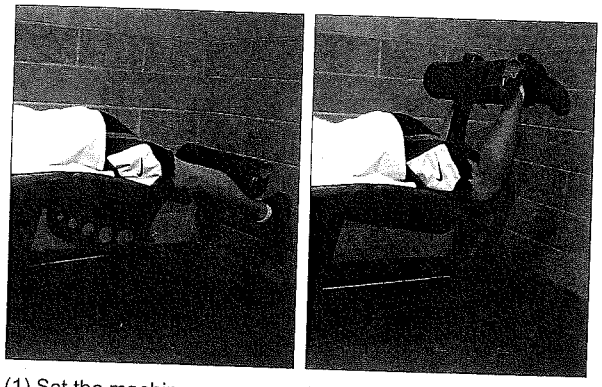
(1) Place the bar on your shoulders. Stand shoulder-width apart. Point your feet slightly outwards.

(2) Slowly bend your knees and hips in unison. The bar should descend in a straight line.

(3) Continue until your thighs are just above parallel to the ground.

(4) Using your legs, push back up to the starting position. You should feel most of the weight on your heels.

HAMSTRING CURLS



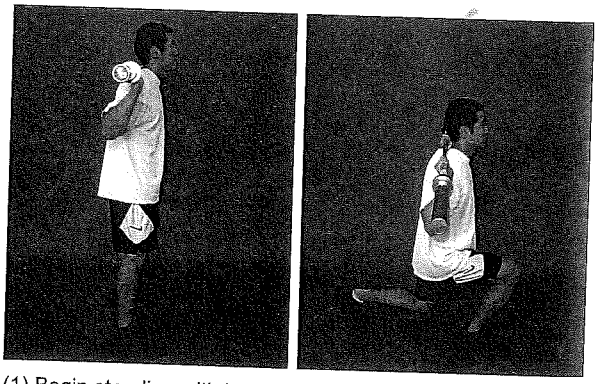
(1) Set the machine so your knees line up with its centre of rotation.

(2) Lie on the padded surface.

(3) Slowly curl your feet towards your buttocks.

(4) Slowly lower your legs back to the starting position.

LUNGES



(1) Begin standing with legs together.

(2) Slowly take a step forward with one foot.

(3) Bend your knee, making sure you maintain your balance and your knee is in line with your toes.

(4) Return to starting position.

These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

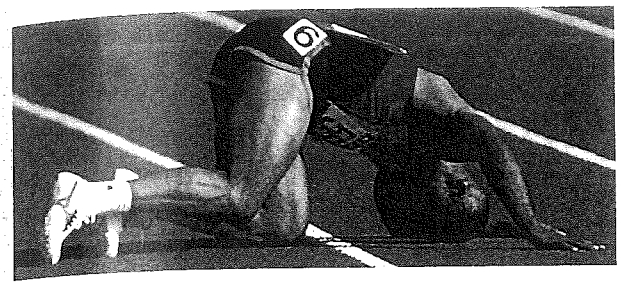


Figure 8.5 Hamstring strains are very common among sprinters, and are often caused by muscle imbalances.

strong quadriceps are a main reason why hamstring strains occur so frequently. To reduce strength imbalances, rehabilitative exercises and strength and conditioning programs should emphasize the quadriceps and hamstrings equally. An example of a balanced workout program can be found in the box *Avoiding Hamstring Strains.*

Common Sprains

Ankle Sprains Ankle sprains are among the most common athletic injuries. You can sprain your ankle running, walking, dancing, or just stepping off a curb. Most common is the **lateral ankle sprain.** Lateral ankle sprains, or inversion sprains, occur when stress is applied (see box *Prevention of an Ankle Sprain*).

A "pop" or tearing noise is usually heard at the time of injury. The joint will swell rapidly and the person is usually unable to walk. Point tenderness will be localized over the anterior talofibular ligament and may extend over the calcaneofibular ligament.

Proper rehabilitation is important to prevent reinjury. Research indicates that a main reason why ankle sprains reoccur is decreased proprioception following the initial sprain. **Proprioception** is the ability to sense the position of a joint in space. Balance exercises, such as wobble board exercises, help improve proprioception. This component of rehabilitation is often neglected because people tend to think they are healed once the pain is gone. Unfortunately their proprioceptive abilities are not healed and they are more likely to suffer another injury.

Dislocations

If the forces acting on a joint are great enough to push the joint beyond its normal anatomical limits, a dislocation may occur. In a dislocation, the joint surfaces come apart. When the ligaments and other supporting structures of the joint are stretched and torn enough to allow the bony surfaces to partially separate, a **subluxation** has occurred. The joints of the fingers are the most commonly dislocated, followed by the shoulder. Dislocations may become chronic depending on the amount of damage to the ligaments and other supporting structures, and on the treatment and rehabilitation of the original injury.

Dislocation of the Shoulder

The shoulder joint is the most mobile joint in our bodies, but by virtue of this mobility it is also the most unstable. There are two basic categories of dislocations: partial and complete. A **partial dislocation**, or subluxation, indicates that the head of the humerus (ball) is partially out of the glenoid fossa (socket). A **complete dislocation** occurs when the head of the humerus is completely out of the socket. Of course, the greater degree of joint dislocation indicates greater

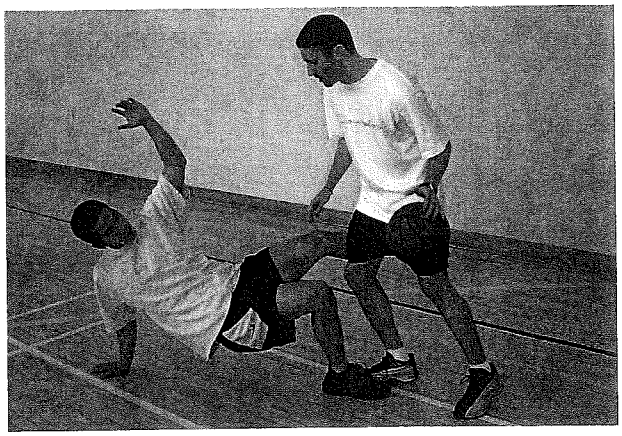
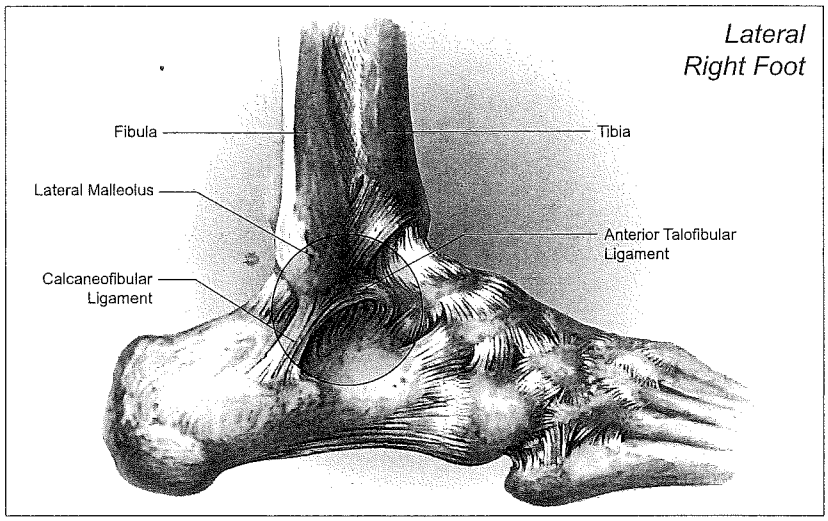


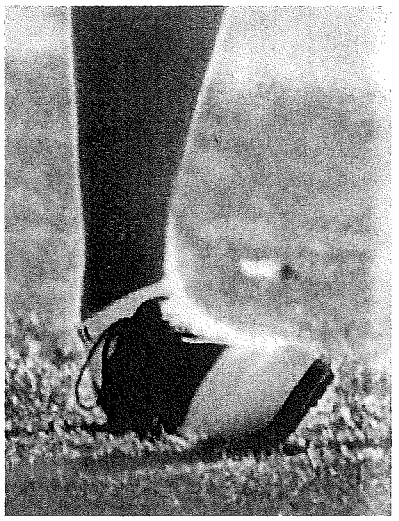
Figure 8.6 Falling and landing on an extended outstretched arm is one way to dislocate your shoulder joint.

Prevention of an Ankle Sprain

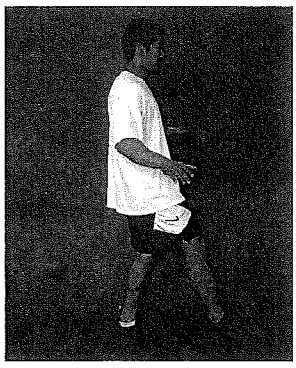
Prevention

- **Limit running on uneven surfaces.** Uneven surfaces increase the chance of ankle sprains.
- **Improve balance.** Even if you don't have an ankle problem, balance exercises can help prevent possible future injuries.
- **Wear proper well-cushioned shoes.** Shoes that are worn or that don't fit properly should be replaced. Wear shoes that provide stability, especially if you play a sport that requires a lot of changes of direction, such as basketball.
- **Monitor fatigue.** If you are feeling unusually tired, stop and rest.
- **Stay hydrated.** Water is a key lubricant that permits bones, muscles, and connective tissues to slide against each other.
- **Strengthen the ankle stabilizers.** An excellent way to strengthen the muscles, tendons, and ligaments around the ankle joint is to run along the shores of a sandy beach.





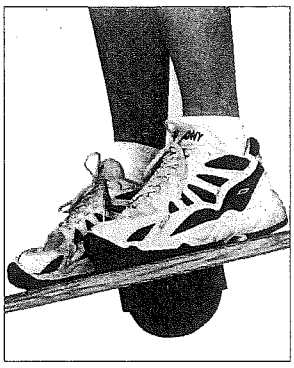
ONE-LEGGED BALANCE



(1) Stand on one foot while performing simple movements of the arms and non-weight-bearing leg.

* Try writing letters or numbers with your arms or free leg.

WOBBLE BOARD

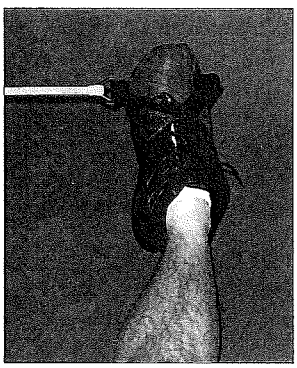


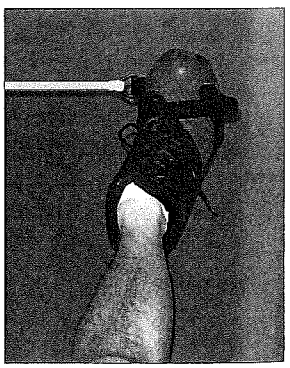
(1) Stand with your feet spread just inside shoulder-width on the wobble board.

(2) Balance.

* Try closing your eyes to challenge yourself.

ANKLE STRENGTHENING EXERCISES





(1) Tie some exercise tubing around the outside of your foot.

(2) Attach the tubing to something solid.

(3) Begin exercises with foot inverted.

(4) Slowly evert your foot. You should feel the muscles on the outside of your leg (peroneals) contracting.

* Perform 15-20 reps x 3 sets, three times a week.

These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

injury. A shoulder dislocation requires medical treatment to relocate the head of the humerus back into the glenoid fossa.

The most common type of shoulder dislocation occurs when the head of the humerus slips anteriorly. This can happen when you're falling backwards and you land on an extended outstretched arm (Figure 8.6). Because your arm is locked all the forces get transmitted to the front of the shoulder, causing the dislocation. The rotator cuff muscles help stabilize the joint, so a great deal of force is required for dislocations to occur.

Symptoms that occur with shoulder dislocations include swelling, numbness, pain, weakness, and bruising. In severe dislocations, the capsule that surrounds the shoulder joint can tear, along with muscles of the rotator cuff. An infrequent but serious complication of shoulder dislocations is injury to the brachial plexus. This is a group of nerves that exit from your neck and travel underneath the clavicle anterior to the head of the humerus. The brachial plexus innervates all the muscles of your chest, shoulder, arm, forearm, and hand. When the shoulder is dislocated forward, the brachial plexus may be injured.

Fractures

Bone fractures may be simple or compound. A **simple fracture** stays within the surrounding soft tissue, whereas a **compound fracture** protrudes from the skin. A **stress fracture** results from repeated low-magnitude training loads. Another type of fracture is an **avulsion fracture**, which involves a tendon or ligament pulling a small chip of bone away from the rest of the bone. Typically this occurs in children and involves explosive throwing and jumping movements.

Concussions

A **concussion** is an injury to the brain that usually develops from a violent shaking or jarring action of the head. The force of impact causes the brain to bounce against the inside of the skull. This results in confusion and a temporary loss of normal brain function, such as memory, judgement, reflexes, speech, muscle coordination, and balance.

Approximately 20 percent of concussions occur in organized sports. They are common in hockey, football, boxing, and many other contact sports. Athletes with a previous concussion are three to six times more likely to suffer another one.

For years, coaches would urge an injured player to "shake it off" and return after a brief rest. This casual attitude has changed in recent

Did You Know?

Helmets are a good idea for activities such as bicycling, in-line skating, and scooter riding. Skateboarders need special helmets that provide more coverage for the back of the head (especially for beginners who tend to fall backwards more often).

Research has shown that a properly fitted bicycle helmet offers up to 88 percent protection from brain injury (Figure 8.7).

Always replace helmets that have sustained a significant impact. Helmets are effective for one fall – one time use only! Also, avoid buying "used" helmets to ensure maximum protection.

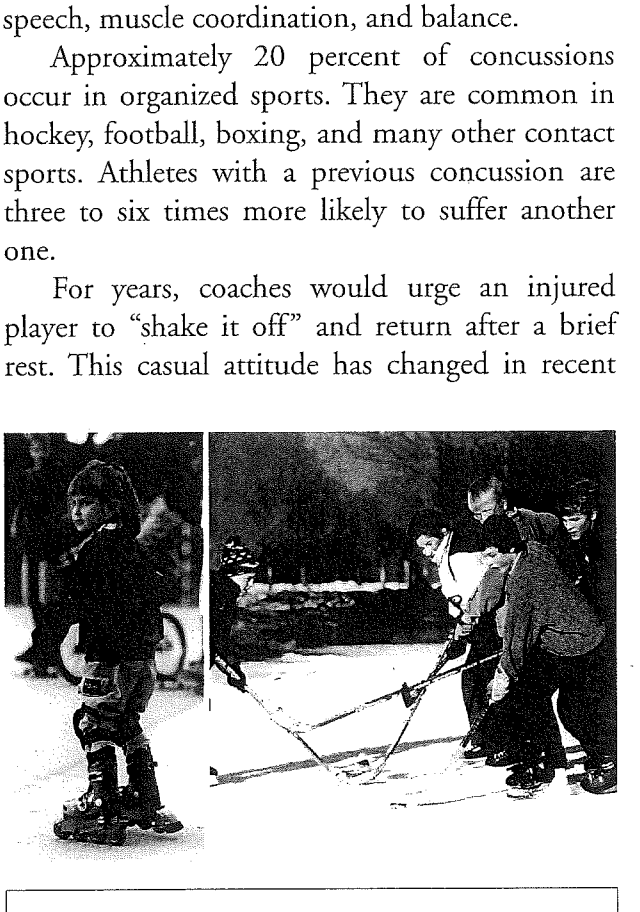
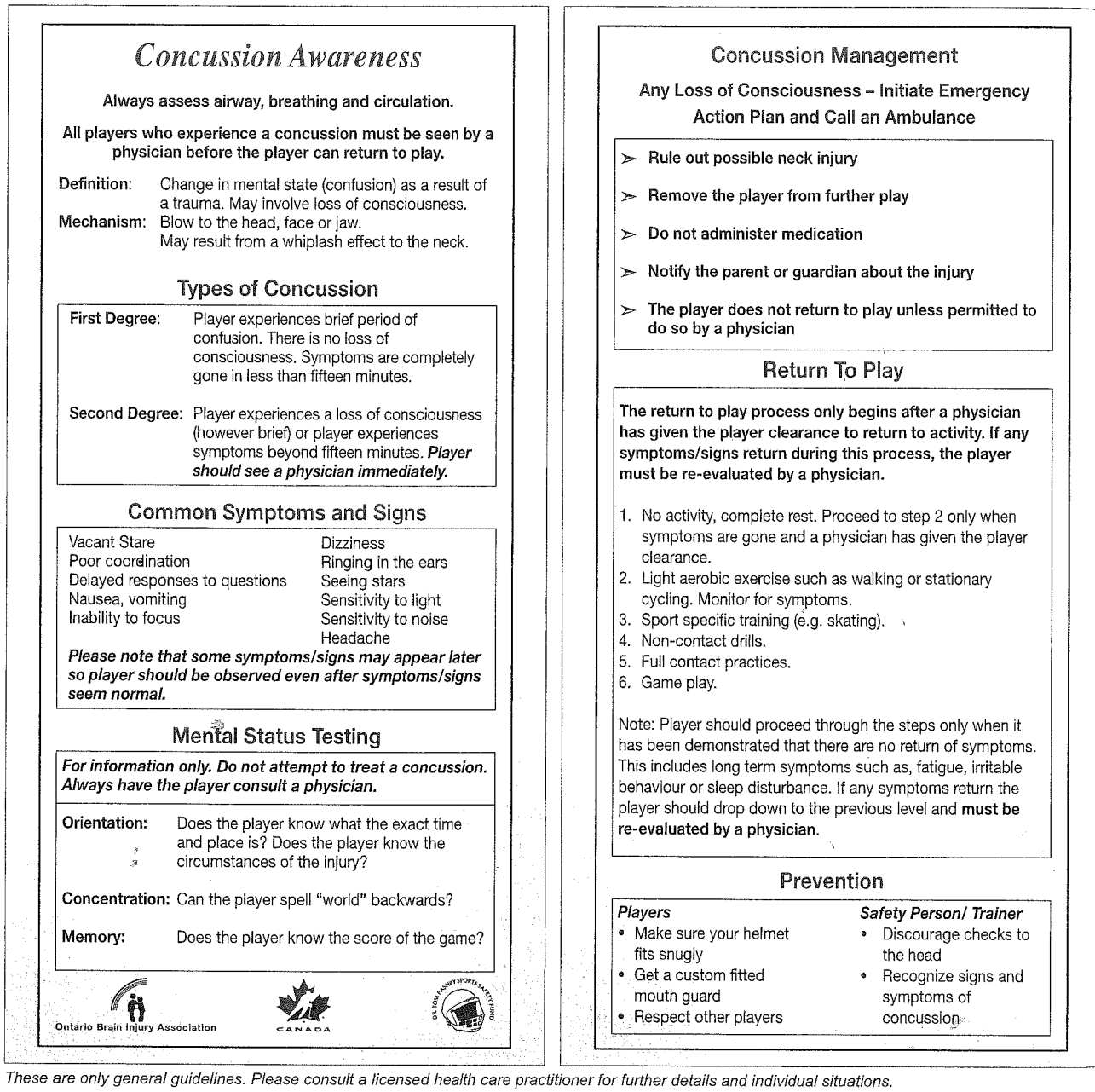


Figure 8.7 These kids are forgetting the most important piece of safety equipment – the helmet.



Concussion Awareness

Always assess airway, breathing and circulation.

All players who experience a concussion must be seen by a physician before the player can return to play.

Definition: Change in mental state (confusion) as a result of a trauma. May involve loss of consciousness.

Mechanism: Blow to the head, face or jaw. May result from a whiplash effect to the neck.

Types of Concussion

First Degree: Player experiences brief period of confusion. There is no loss of consciousness. Symptoms are completely gone in less than fifteen minutes.

Second Degree: Player experiences a loss of consciousness (however brief) or player experiences symptoms beyond fifteen minutes. ***Player should see a physician immediately.***

Common Symptoms and Signs

Vacant Stare	Dizziness
Poor coordination	Ringing in the ears
Delayed responses to questions	Seeing stars
Nausea, vomiting	Sensitivity to light
Inability to focus	Sensitivity to noise
	Headache

Please note that some symptoms/signs may appear later so player should be observed even after symptoms/signs seem normal.

Mental Status Testing

For information only. Do not attempt to treat a concussion. Always have the player consult a physician.

Orientation: Does the player know what the exact time and place is? Does the player know the circumstances of the injury?

Concentration: Can the player spell "world" backwards?

Memory: Does the player know the score of the game?

Ontario Brain Injury Association

CANADA

Concussion Management

Any Loss of Consciousness – Initiate Emergency Action Plan and Call an Ambulance

- **Rule out possible neck injury**
- **Remove the player from further play**
- **Do not administer medication**
- **Notify the parent or guardian about the injury**
- **The player does not return to play unless permitted to do so by a physician**

Return To Play

The return to play process only begins after a physician has given the player clearance to return to activity. If any symptoms/signs return during this process, the player must be re-evaluated by a physician.

1. No activity, complete rest. Proceed to step 2 only when symptoms are gone and a physician has given the player clearance.
2. Light aerobic exercise such as walking or stationary cycling. Monitor for symptoms.
3. Sport specific training (e.g. skating).
4. Non-contact drills.
5. Full contact practices.
6. Game play.

Note: Player should proceed through the steps only when it has been demonstrated that there are no return of symptoms. This includes long term symptoms such as, fatigue, irritable behaviour or sleep disturbance. If any symptoms return the player should drop down to the previous level and **must be re-evaluated by a physician.**

Prevention

Players	*Safety Person/ Trainer*
• Make sure your helmet fits snugly	• Discourage checks to the head
• Get a custom fitted mouth guard	• Recognize signs and symptoms of concussion
• Respect other players	

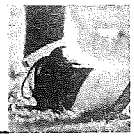
These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

Figure 8.8 Hockey Canada Safety Program: Concussion Card.

years due to concussion-related retirements of Brett Lindros from hockey and Steve Young from football. Neurosurgeons and other brain injury experts emphasize that although some concussions are less serious than others, there is no such thing as a "minor concussion." The Canadian Hockey Association has developed a safety program using the "Concussion Card" to increase awareness of concussions (Figure 8.8).

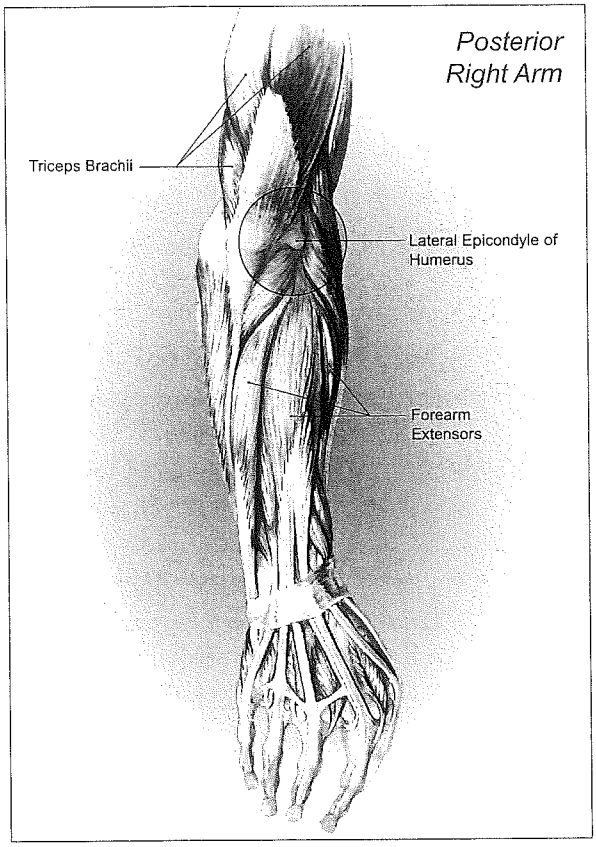
Overuse Injuries

Overuse injuries are often the result of repeated microtrauma to the tissues, which do not have sufficient recovery time to heal. This accumulated microtrauma can result from poor technique, equipment that puts unusual stresses on the tissues, and the amount or type of training an athlete is



Preventing Lateral Epicondylitis

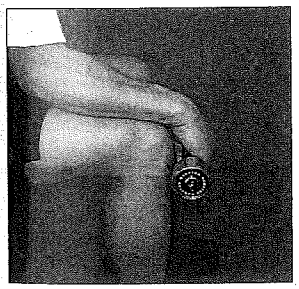
Lateral epicondylitis, commonly known as *tennis elbow*, tends to occur in people who play tennis or other racquet sports. The most common cause of this condition is improper technique or overuse. Below are a few things you can do to prevent it.



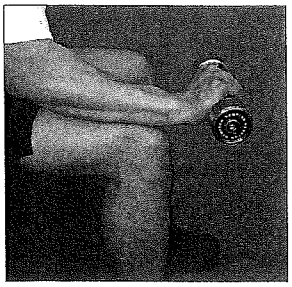
Prevention

- **Analyze your arm motions.** This is very important to reduce unnecessary stress on the lateral epicondyle. Always seek professional guidance whenever starting a new activity.
- **Exercise to strengthen your forearm extensors/supinators.** Use either exercise tubing or free weights.
- **Stretch after exercise.** Stretching keeps your muscles flexible and better able to tolerate eccentric loads.
- **Use compression straps.** Straps reduce the tensile load at the lateral epicondyle.
- **Apply ice.** Even if you do not feel discomfort after the activity it is important to ice.

FOREARM EXTENSOR EXERCISE



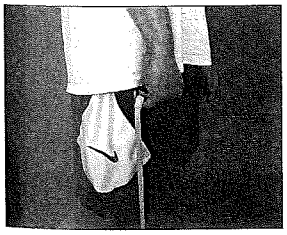
(1) Begin with the wrist in maximum flexion.



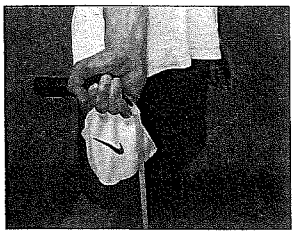
(2) Extend the wrist.

* Perform 15-20 reps x 3 sets, three times a week.

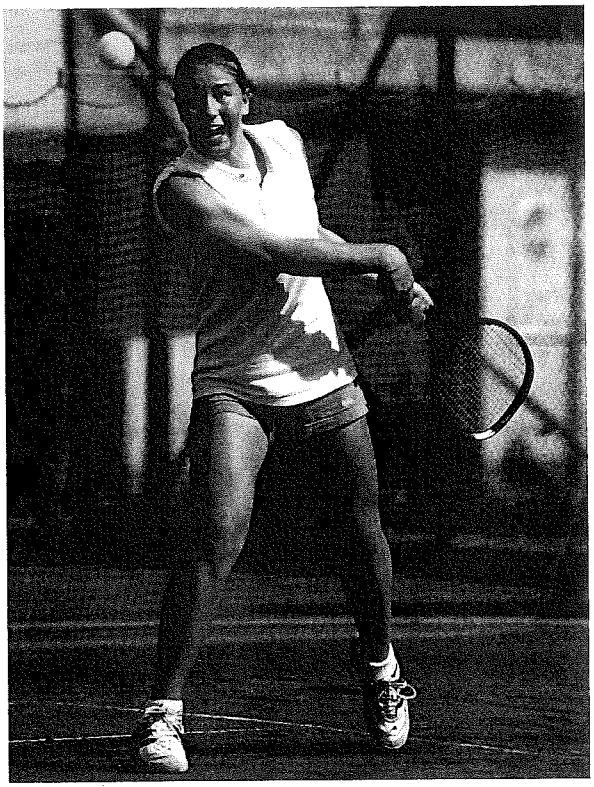
SUPINATOR EXERCISE



(1) Begin with the forearm in maximum pronation.



(2) Supinate the forearm.



These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

doing. Common types of overuse injuries include tendonitis, bursitis, shoulder impingement, and stress fractures.

Tendonitis

A tendon is a type of connective tissue that connects your muscles to your bones. **Tendonitis** occurs when a tendon becomes inflamed initially, then weakened and degenerative, and is usually the result of a "microtrauma" in the tendon caused by excessive repetitive motions. Age can also contribute to the incidence of tendonitis because muscles and tendons lose their elasticity with age. Tendonitis produces pain, tenderness, and stiffness near a joint and is aggravated by movement.

Your risk of developing tendonitis increases if you perform excessive repetitive motions. For example, soccer and basketball players, runners, and dancers are prone to tendonitis in their legs and feet. Baseball players, swimmers, tennis players, and golfers are susceptible to tendonitis in their shoulders and elbows. The risk of developing tendonitis increases further if you use improper technique.

Tennis Elbow

Lateral epicondylitis, commonly known as **tennis elbow**, affects tendons of your forearm extensor/supinator muscles. These muscles attach to the lateral epicondyle of the humerus and are responsible for extending your wrist and fingers (see box *Preventing Lateral Epicondylitis*).

People who play tennis or other racquet sports may develop this problem. Contributing factors include excessive forearm pronation and wrist flexion during forehand strokes, gripping the racquet too tightly, improper size grip, excessive string tension, excessive racquet weight or stiffness, faulty backhand technique, putting topspin on backhand strokes, or hitting the ball off-centre.

Golfer's Elbow and Little League Elbow

Medial epicondylitis, commonly known as **golfer's elbow**, is similar to tennis elbow but it occurs on the inner side. This condition affects the tendons of the forearm flexors/pronators which attach to the medial epicondyle of the humerus. These muscles are responsible for flexing your wrist and fingers and pronating your forearm.

In severe injuries the ulnar collateral ligament and ulnar nerve can be injured. If the ulnar nerve is involved tingling and numbness may radiate into the forearm and hand, particularly affecting the fourth and fifth fingers. Other activities that can irritate the medial epicondyle include racquet sports and using a computer mouse.

Medial epicondylitis affecting the medial humeral growth plate in young children or adolescents is called **little league elbow**. This occurs primarily when young baseball players, usually around the age of 12-14, begin to throw curveballs. The excessive forces required to throw a curveball exceed the tissue tolerance of the medial epicondyle. For this reason teaching players under the age of 16 how to throw a curveball is discouraged.

Jumper's Knee

Pain affecting the infrapatellar ligament, known as **patellar tendonitis** or **jumper's knee**, is caused by repetitive eccentric knee actions, such as jumping in volleyball, basketball, and track and field events. The eccentric load affects the quadriceps during jump preparation, when the forces experienced are several times larger than the athlete's body weight.

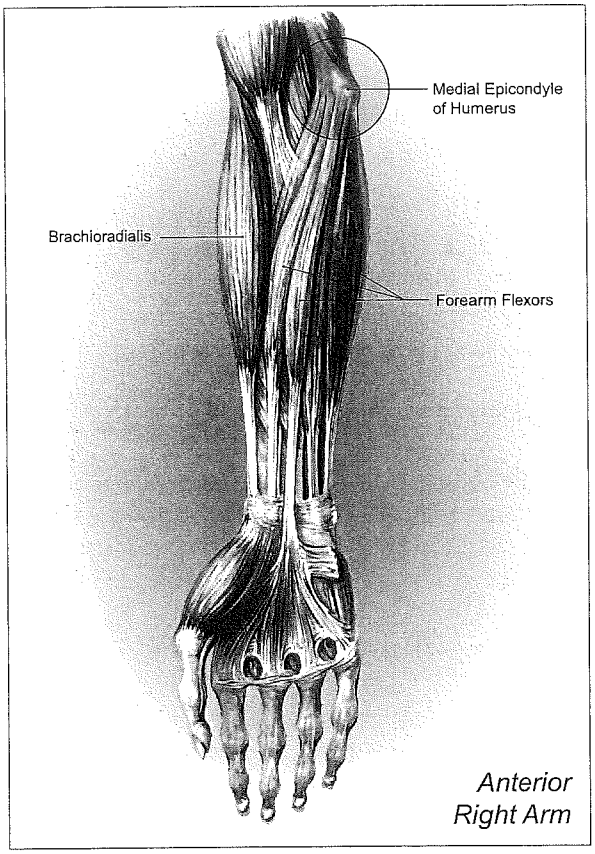
Bursitis

Bursitis describes inflammation of the bursae. Like tendonitis, it results from overuse and stress. Your body contains more than 150 bursae – tiny fluid-filled sacs that lubricate and cushion pressure points between your bones and tendons (Figure 8.9). When they become inflamed, movement and direct pressure cause pain.

Bursitis is most common in the shoulder, elbow, and hip joints. Again, the mechanism of injury is excessive repetitive movements. For

Preventing Medial Epicondylitis

Medial epicondylitis, also known as *golfer's elbow*, occurs commonly in people who play golf or racquet sports. It also occurs frequently among people who use a computer mouse. Medial epicondylitis affecting the humeral growth plate in children or adolescents is called *little league elbow*. Listed below are a few things you can do to prevent this condition.

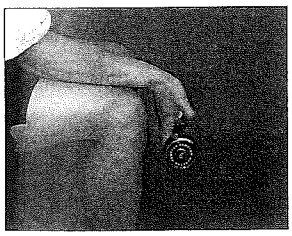


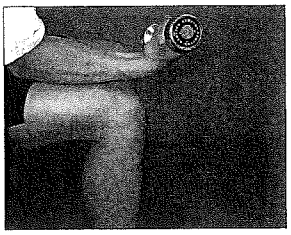
Anterior Right Arm

Prevention

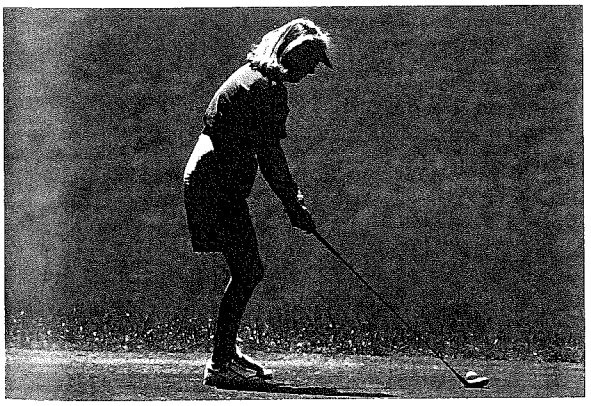
- **Analyze your arm motions.** This is important to reduce unnecessary stress on the medial epicondyle. Always seek professional guidance whenever starting a new activity.
- **Exercise to strengthen your forearm flexors/ pronators.** Use either exercise tubing or free weights.
- **Stretch after exercise.** Stretching keeps your muscles flexible and better able to tolerate eccentric loads.
- **Apply ice.** Even if you do not feel discomfort after the activity it is important to ice.

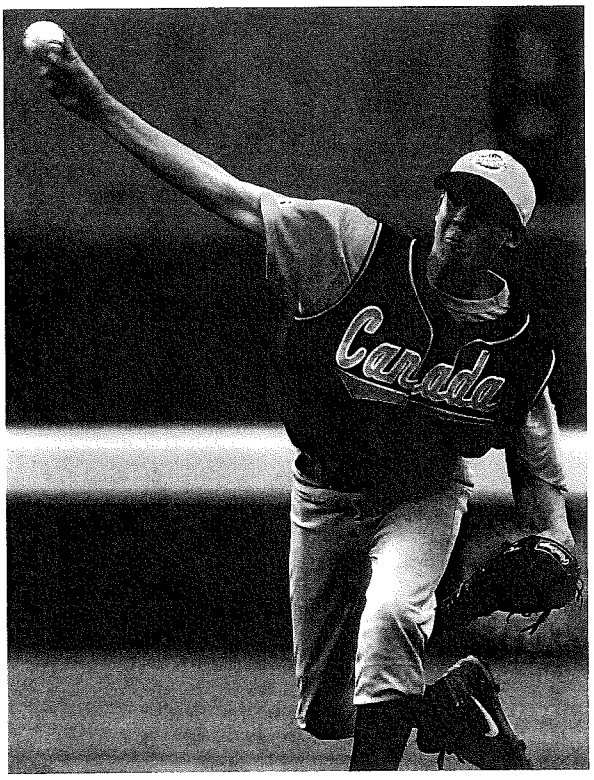
FOREARM FLEXOR EXERCISE


(1) Begin with the wrist in maximum extension.


(2) Flex the wrist.

* Perform 15-20 reps x 3 sets, three times a week.



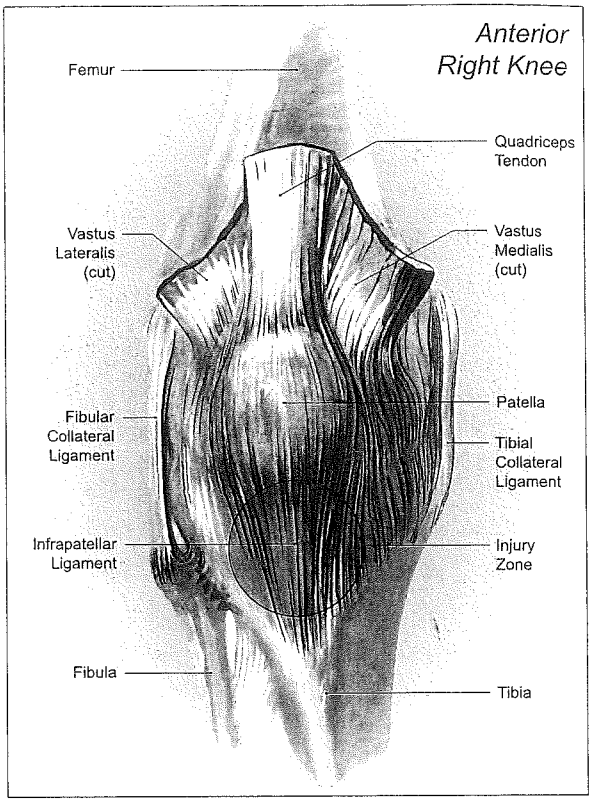


These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

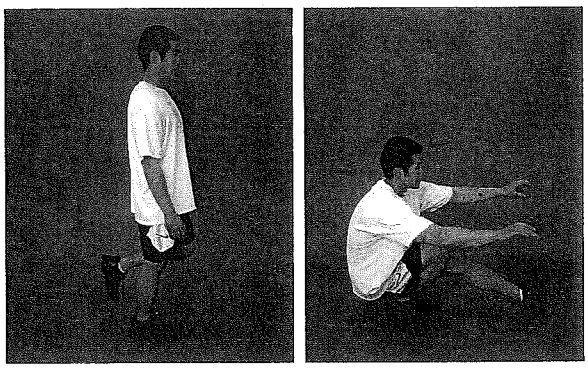
Prevention of Jumper's Knee

Prevention

- **Maximize quadriceps and hamstring strength.** A balanced workout program is important to prevent injury.
- **Perform repetitive eccentric quadriceps exercises.** Gradually increase load to prepare the body to withstand repetitive loading.
- **Stretch after exercise.** Stretching keeps your muscles flexible and better able to tolerate eccentric loads.
- **Train on cushioned surfaces and wear well-cushioned footwear.** This decreases the forces acting on the knee.
- **Apply ice.** Even if you do not feel discomfort after the activity it is important to ice.
- **Seek medical treatment.** If you experience symptoms, seek medical attention to prevent future problems.



SINGLE LEG SQUATS



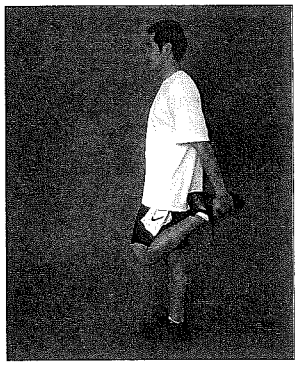
(1) Balance on one leg.

(2) Slowly lower yourself, making sure your knee and pelvis are in good alignment throughout the exercise.

(3) Only go as deep as you are able to maintain form.

* Perform 10 reps x 3 sets, three times a week.

QUAD STRETCH



(1) Grasp your ankle.

(2) Slowly bring your foot to your buttocks.

* You may find it difficult on one foot, so try touching your belly button with your free hand.

These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.

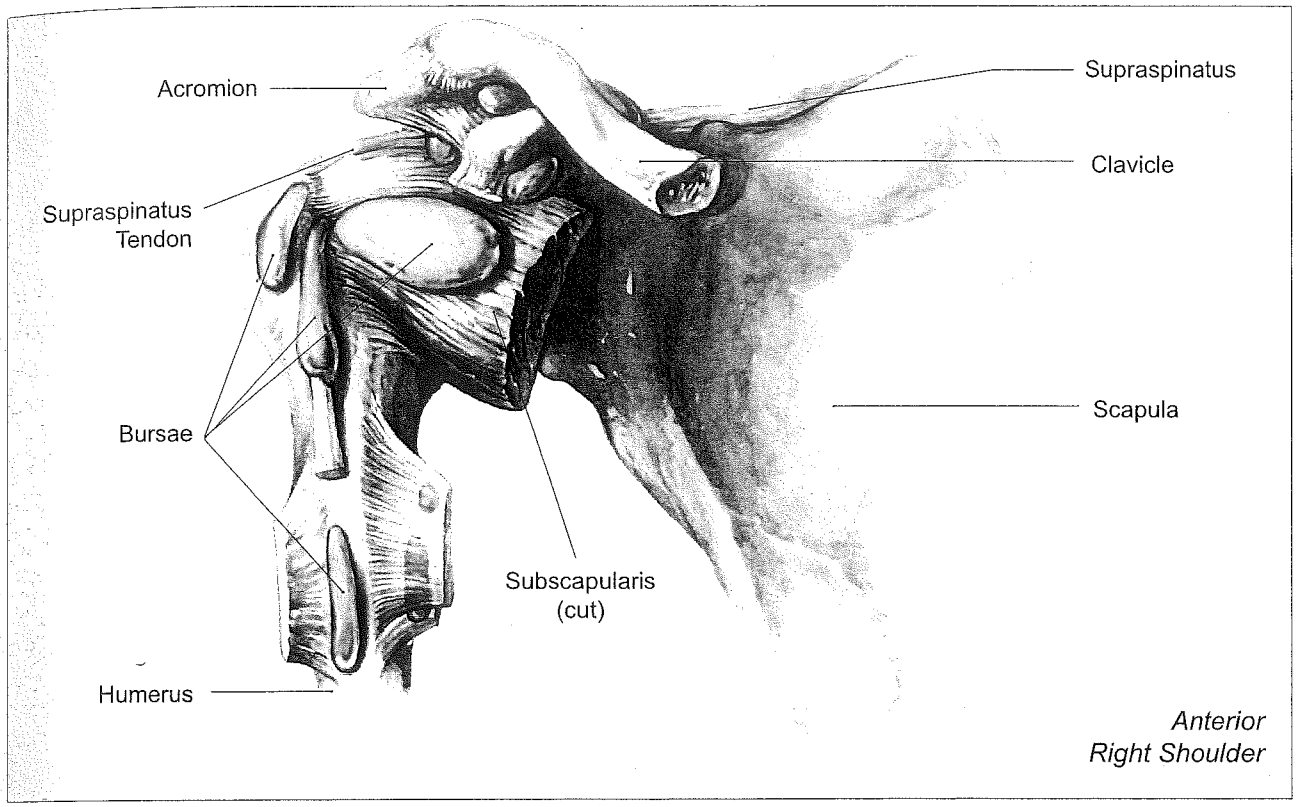


Figure 8.9 Bursae around the shoulder joint.

example, frequent extension of the arm at high speeds, such as in baseball pitching, can cause bursitis. Medical research indicates that you are more likely to develop bursitis with increasing age.

Shoulder Impingement

Shoulder impingement is a very common problem with athletes, industrial workers, and anyone who uses their shoulders repeatedly. Excess movement of the humeral head combined with a lack of space between the humeral head and the acromion causes inflammation in the bursae or rotator cuff tendons in the shoulder.

Muscle imbalances in the shoulder are largely responsible for development of shoulder impingement. The main culprit is weak shoulder depressors (lower fibres of the trapezius and serratus anterior) compared with the shoulder elevators (upper fibres of the trapezius). Likewise, a tight pectoralis major muscle may cause the humeral head to rotate anteriorly, increasing the potential for shoulder impingement.

Stress Fractures

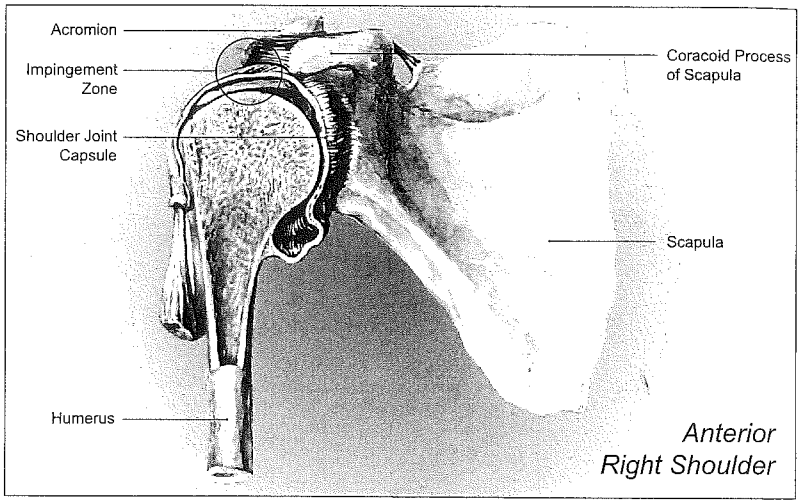
A **stress fracture** is a special type of fracture that results from repeated low-magnitude forces. It begins as a small disruption in the continuity of the outer layers of cortical bone. With continued stress to the weakened bone, complete cortical bone fracture can occur. Stress fractures of the metatarsals, femoral neck, and pubis are common in runners who overtrain.

It is important to note the distinction between a stress fracture and shin splints, because the two terms are often used interchangeably. **Shin splints** describe pain that occurs along the inner surface of the tibia. Common causes include vigorous high-impact activity, training on hard surfaces, improper training protocols, poorly cushioned footwear, and having flat feet. Shin splints involve pain and inflammation without a disruption of

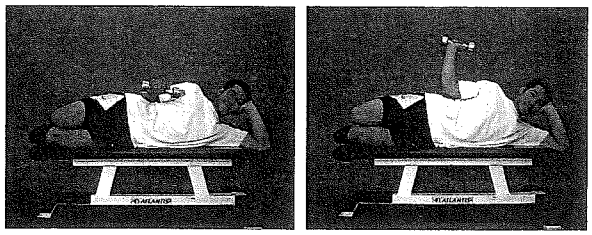
Avoiding Shoulder Impingement

Prevention

- **Make sure your shoulders are depressed when doing any exercises.** Elevating your shoulders while doing an activity decreases the space between the humerus and acromion, making impingement more likely.
- **Stretch the pectoralis major muscle.** A tight pectoralis major muscle may cause the humeral head to rotate anteriorly, thereby increasing the risk of shoulder impingement.
- **Strengthen the supporting muscles surrounding the shoulder joint.** These muscles help prevent anterior rotation of the humerus, thereby reducing the risk of shoulder impingement.
- **Reduce activity.** If your shoulders become painful reduce your activity levels.
- **Apply ice.** Even if you do not feel discomfort after the activity it is important to ice.

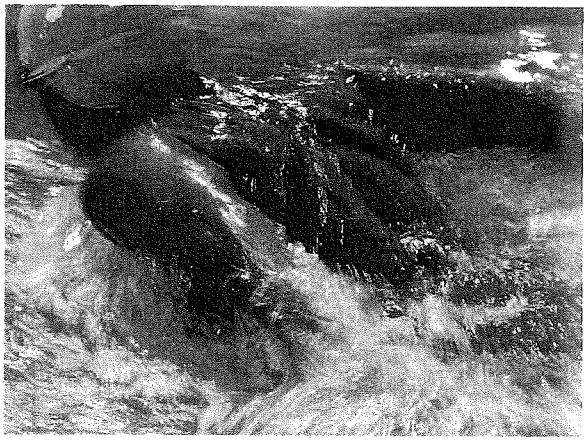


EXTERNAL ROTATORS EXERCISE

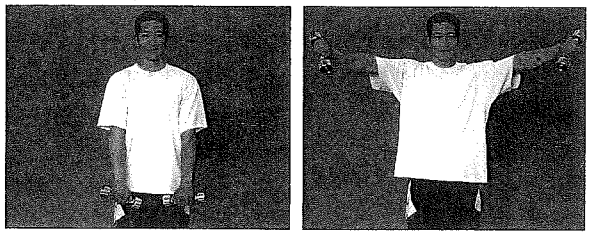


(1) Begin with your arm flexed at your side, with your shoulder internally rotated.

(2) Rotate your arm out to the side like you are opening a door, making sure your shoulder is always depressed.



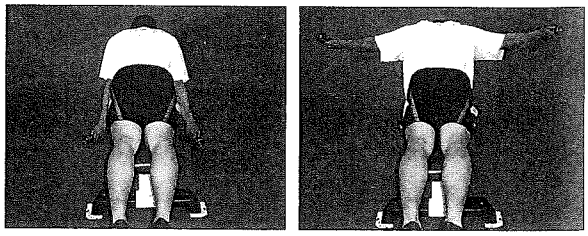
EMPTY CAN EXERCISE



(1) Begin with your arm straight at your side, making sure your thumb is pointing down to the floor.

(2) Abduct your arm slowly, making sure there is about 30 degrees of horizontal abduction and your shoulders are depressed.

LOWER TRAPEZIUS EXERCISE



(1) Lie on the ground or on a bench with your arms abducted to 90 degrees. Your palms should face the ceiling.

(2) Squeeze your shoulder blades together, making sure they are depressed and your palms are facing the ceiling.

These are only general guidelines. Please consult a licensed health care practitioner for further details and individual situations.