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A PROJECT ON

Various types of sports injuries in badminton and their
management



by

~~ADARSH RAJ GAUR~~
~~BADMINTON COACH~~
~~L.N.U.P.E. (GWALIOR)~~

CHAPTER - I

INTRODUCTION OF BADMINTON

Badminton, game played on an indoor court by two or four players with rackets and a shuttlecock. The net is fixed so that its top edge is 1.52 m (5 ft) from the floor at the centre and 1.55 m (5 ft 1 in) at the posts. The racket is lightweight and approximately 66 cm (26 in) long, while its head is 21 cm (8.5 in) wide at its broadest point. The shuttlecock has a cork base fitted with 16 goose feathers to stabilize it: many of the feathers are now made of nylon or plastic. The court resembles that in tennis and is 13.4 m (44 ft) long and 6.1 m (20 ft) wide.

The scoring differs from tennis however. In singles, the server starts in the right service court and serves into the opposite right service court. If the server wins a rally, one point is scored. The next service is from the left court to the opposite left court. This alternating process goes on so long as the server is winning points. Only the server can win points: should he or she lose a rally, the other player does not win a point but instead wins the right to serve. As in tennis, points are won when a player cannot return the shuttlecock or hits it out of the court. Generally, 15 points wins the game provided the score of the winner exceeds that of the loser by at least two

points, and victory in two games wins the match. Rules for championship play set different deciding scores and tie-breaking procedures for men's, women's, and doubles matches.

The sport abounds in positional play, especially in the doubles game, where long rallies are common place. There is a wide variety of stroke play ranging in power from delicate drop shots up to fierce overhead smashes, and the players need quick reflexes as well as a sharp turn of speed.

The game is named after Badminton in Gloucestershire, England, which is the family seat of the dukes of Beaufort. It is believed to have been invented there in about 1867. It is possible, however, that British army officers had already devised it as a recreation in India and brought it to the Beaufort family. Its most obvious forerunner is the old English game of battledore and shuttlecock, and a similar game was also played in China over 2,000 years ago. Badminton became popular very quickly and the Badminton Association was founded in Great Britain in 1893. The sport has also flourished in Denmark, Japan, China, South Korea, Indonesia, Malaysia, Australia, and New Zealand. A very high proportion of champions (both men and women) come from the Far East. The world governing body is the International Badminton Federation, founded in 1934, which now has 147 affiliated member nations.

The principal competitions are: the Men's World Team Championship, otherwise known as the Thomas Cup, which was first competed for in 1948-1949; the Women's World Team Championship, instituted in 1977 and now staged biennially; the All England Championships, first played for in 1899 and open to competitors from all nations; and the European Championships, staged biennially from 1968. Badminton was played as a demonstration sport in the 1972 and 1988 Olympics and became a medal sport in 1992 when all the champions were from Indonesia and South Korea. Since then the game has seen the emergence of Chinese players, with four of the five gold medals at the Sydney Olympics (in 2000) going to Chinese competitors.

CHAPTER - II

INTRODUCTION OF SPORTS INJURIES IN BADMINTON

In recent years, increasing numbers of people of all ages have been heeding their health professionals' advice to get active for all of the health benefits exercise has to offer. But for some people—particularly those who overdo or who don't properly train or warm up—these benefits can come at a price: sports injuries. Fortunately, most sports injuries can be treated effectively, and most people who suffer injuries can return to a satisfying level of physical activity after an injury. Even better, many sports injuries can be prevented if people take the proper precautions.

This booklet answers frequently asked questions about sports injuries. It discusses some of the most common injuries and their treatment, and injury prevention. The booklet is for anyone who has a sports injury or who is physically active and wants to prevent sports injuries. It is for casual and more serious athletes as well as the trainers, coaches, and health professionals who deal with sports injuries.

Sports Injuries in badminton

The term sports injury, in the broadest sense, refers to the kinds of injuries that most commonly occur during sports or exercise. Some sports injuries

result from accidents; others are due to poor training practices, improper equipment, lack of conditioning, or insufficient warmup and stretching. Although virtually any part of your body can be injured during sports or exercise, the term is usually reserved for injuries that involve the musculoskeletal system, which includes the muscles, bones, and associated tissues like cartilage. Traumatic brain and spinal cord injuries, (relatively rare during sports or exercise) and bruises are considered briefly in the following. Following are some of the most common sports injuries.

Sprains and Strains

A sprain is a stretch or tear of a ligament, the band of connective tissues that joins the end of one bone with another. Sprains are caused by trauma such as a fall or blow to the body that knocks a joint out of position and, in the worst case, ruptures the supporting ligaments. Sprains can range from first degree (minimally stretched ligament) to third degree (a complete tear). Areas of the body most vulnerable to sprains are ankles, knees, and wrists. Signs of a sprain include varying degrees of tenderness or pain; bruising; inflammation; swelling; inability to move a limb or joint; or joint looseness, laxity, or instability.

A strain is a twist, pull, or tear of a muscle or tendon, a cord of tissue connecting muscle to bone. It is an acute, noncontact injury that results from overstretching or overcontraction. Symptoms of a strain include pain, muscle spasm, and loss of strength. While it's hard to tell the difference between mild and moderate strains, severe strains not treated professionally can cause damage and loss of function.

Knee Injuries

Because of its complex structure and weight-bearing capacity, the knee is the most commonly injured joint. Each year, more than 5.5 million people visit orthopaedic surgeons for knee problems.

Knee injuries can range from mild to severe. Some of the less severe, yet still painful and functionally limiting, knee problems are runner's knee (pain or tenderness close to or under the knee cap at the front or side of the knee), iliotibial band syndrome (pain on the outer side of the knee), and tendonitis, also called tendinosis (marked by degeneration within a tendon, usually where it joins the bone).

More severe injuries include bone bruises or damage to the cartilage or ligaments. There are two types of cartilage in the knee. One is the meniscus, a crescent-shaped disc that absorbs shock between the thigh (femur) and

lower leg bones (tibia and fibula). The other is a surface-coating (or articular) cartilage. It covers the ends of the bones where they meet, allowing them to glide against one another. The four major ligaments that support the knee are the anterior cruciate ligament (ACL), the posterior cruciate ligament (PCL), the medial collateral ligament (MCL), and the lateral collateral ligament (LCL). (See diagram.)

Knee injuries can result from a blow to or twist of the knee; from improper landing after a jump; or from running too hard, too much, or without proper warmup.

Compartment Syndrome

In many parts of the body, muscles (along with the nerves and blood vessels that run alongside and through them) are enclosed in a "compartment" formed of a tough membrane called fascia. When muscles become swollen, they can fill the compartment to capacity, causing interference with nerves and blood vessels as well as damage to the muscles themselves. The resulting painful condition is referred to as compartment syndrome.

Compartment syndrome may be caused by a one-time traumatic injury (acute compartment syndrome), such as a fractured bone or a hard blow to the thigh, by repeated hard blows (depending upon the sport), or by ongoing

overuse (chronic exertional compartment syndrome), which may occur, for example, in long-distance running.

Shin Splints

While the term "shin splints" has been widely used to describe any sort of leg pain associated with exercise, the term actually refers to pain along the tibia or shin bone, the large bone in the front of the lower leg. This pain can occur at the front outside part of the lower leg, including the foot and ankle (anterior shin splints) or at the inner edge of the bone where it meets the calf muscles (medial shin splints).

Shin splints are primarily seen in runners, particularly those just starting a running program. Risk factors for shin splints include overuse or incorrect use of the lower leg; improper stretching, warmup, or exercise technique; overtraining; running or jumping on hard surfaces; and running in shoes that don't have enough support. These injuries are often associated with flat (overpronated) feet.

Achilles Tendon Injuries

A stretch, tear, or irritation to the tendon connecting the calf muscle to the back of the heel, Achilles tendon injuries can be so sudden and agonizing

that they have been known to bring down charging professional football players in shocking fashion.

The most common cause of Achilles tendon tears is a problem called tendinitis, a degenerative condition caused by aging or overuse. When a tendon is weakened, trauma can cause it to rupture.

Achilles tendon injuries are common in middle-aged "weekend warriors" who may not exercise regularly or take time to stretch properly before an activity. Among professional athletes, most Achilles injuries seem to occur in quick-acceleration, jumping sports like football and basketball, and almost always end the season's competition for the athlete.

Common Types of Sports Injuries

- Muscle sprains and strains
- Tears of the ligaments that hold joints together
- Tears of the tendons that support joints and allow them to move
- Dislocated joints
- Fractured bones, including vertebrae.

Fractures

A fracture is a break in the bone that can occur from either a quick, one-time injury to the bone (acute fracture) or from repeated stress to the bone over time (stress fracture).

Acute fractures: Acute fractures can be simple (a clean break with little damage to the surrounding tissue) or compound (a break in which the bone pierces the skin with little damage to the surrounding tissue). Most acute fractures are emergencies. One that breaks the skin is especially dangerous because there is a high risk of infection.

Stress fractures: Stress fractures occur largely in the feet and legs and are common in sports that require repetitive impact, primarily running/jumping sports such as gymnastics or track and field. Running creates forces two to three times a person's body weight on the lower limbs.

The most common symptom of a stress fracture is pain at the site that worsens with weight-bearing activity. Tenderness and swelling often accompany the pain.

Dislocations

When the two bones that come together to form a joint become separated, the joint is described as being dislocated. Contact sports such as football and basketball, as well as high-impact sports and sports that can result in excessive stretching or falling, cause the majority of dislocations. A dislocated joint is an emergency situation that requires medical treatment.

The joints most likely to be dislocated are some of the hand joints. Aside from these joints, the joint most frequently dislocated is the shoulder. Dislocations of the knees, hips, and elbows are uncommon.

What's the Difference Between Acute and Chronic Injuries?

Regardless of the specific structure affected, sports injuries can generally be classified in one of two ways: acute or chronic.

Acute Injuries

Acute injuries, such as a sprained ankle, strained back, or fractured hand, occur suddenly during activity. Signs of an acute injury include the following:

- Sudden, severe pain
- Swelling

- Inability to place weight on a lower limb
- Extreme tenderness in an upper limb
- Inability to move a joint through its full range of motion
- Extreme limb weakness
- Visible dislocation or break of a bone.

Chronic Injuries

Chronic injuries usually result from overusing one area of the body while playing a sport or exercising over a long period. The following are signs of a chronic injury:

- Pain when performing an activity
- A dull ache when at rest
- Swelling.

Whether an injury is acute or chronic, there is never a good reason to try to "work through" the pain of an injury. When you have pain from a particular movement or activity, STOP! Continuing the activity only causes further harm. Some injuries require prompt medical attention while others can be self-treated. Here's what you need to know about both types:

CHAPTER - III

MANAGEMENT OF SPORTS INJURIES IN BADMINTON

When to Seek Medical Treatment

You should call a health professional if

- The injury causes severe pain, swelling, or numbness
- You can't tolerate any weight on the area
- The pain or dull ache of an old injury is accompanied by increased swelling or joint abnormality or instability.

To learn about treating sports injuries,

When and How to Treat at Home

If you don't have any of the above symptoms, it's probably safe to treat the injury at home—at least at first. If pain or other symptoms worsen, it's best to check with your health care provider. Use the RICE method to relieve pain and inflammation and speed healing. Follow these four steps immediately after injury and continue for at least 48 hours:

- **Rest.** Reduce regular exercise or activities of daily living as needed. If you cannot put weight on an ankle or knee, crutches

may help. If you use a cane or one crutch for an ankle injury, use it on the uninjured side to help you lean away and relieve weight on the injured ankle.

- **Ice.** Apply an ice pack to the injured area for 20 minutes at a time, four to eight times a day. A cold pack, ice bag, or plastic bag filled with crushed ice and wrapped in a towel can be used. To avoid cold injury and frostbite, do not apply the ice for more than 20 minutes. (Note: Do not use heat immediately after an injury. This tends to increase internal bleeding or swelling. Heat can be used later on to relieve muscle tension and promote relaxation.)
- **Compression.** Compression of the injured area may help reduce swelling. Compression can be achieved with elastic wraps, special boots, air casts, and splints. Ask your health care provider for advice on which one to use.
- **Elevation.** If possible, keep the injured ankle, knee, elbow, or wrist elevated on a pillow, above the level of the heart, to help decrease swelling.

The Body's Healing Process

From the moment a bone breaks or a ligament tears, your body goes to work to repair the damage. Here's what happens at each stage of the healing process:

At the moment of injury: Chemicals are released from damaged cells, triggering a process called inflammation. Blood vessels at the injury site become dilated; blood flow increases to carry nutrients to the site of damage. tissue

Within hours of injury: White blood cells (leukocytes) travel down the bloodstream to the injury site where they begin to tear down and remove damaged tissue, allowing other specialized cells to start developing scar tissue.

Within days of injury: Scar tissue is formed on the skin or inside the body. The amount of scarring may be proportional to the amount of swelling, inflammation, or bleeding within. In the next few weeks, the damaged area will regain a great deal of strength as scar tissue continues to form.

Within a month of injury: Scar tissue may start to shrink, bringing damaged, torn, or separated tissues back together. However, it may be several months or more before the injury is completely healed.

While severe injuries will need to be seen immediately in an emergency room, particularly if they occur on the weekend or after office hours, most sports injuries can be evaluated and, in many cases, treated by your primary health care provider.

Depending on your preference and the severity of your injury or the likelihood that your injury may cause ongoing, long-term problems, you may want to see, or have your primary health care professional refer you to, one of the following:

- **Orthopaedic surgeon:** A doctor specializing in the diagnosis and treatment of the musculoskeletal system, which includes bones, joints, ligaments, tendons, muscles, and nerves.

- **Physical therapist/physiotherapist:** A health care professional who can develop a rehabilitation program. Your primary care physician may refer you to a physical therapist after you begin to recover from your injury to help strengthen muscles and joints and prevent further injury.

How Are Sports Injuries Treated?

Although using the RICE technique described previously can be helpful for any sports injury, RICE is often just a starting point. Here are some other treatments your doctor or other health care provider may administer, recommend, or prescribe to help your injury heal.

Immobilization

Immobilization is a common treatment for sports injuries that may be done immediately by a trainer or paramedic. Immobilization involves reducing movement in the area to prevent further damage. By enabling the blood supply to flow more directly to the injury (or the site of surgery to repair damage from an injury), immobilization reduces pain, swelling, and muscle spasm and helps the healing process begin. Following are some devices used for immobilization:

- **Slings**, to immobilize the upper body, including the arms and shoulders.
- **Splints and casts**, to support and protect injured bones and soft tissue. Casts can be made from plaster or fiberglass. Splints can be custom made or ready made. Standard splints come in a variety of shapes and sizes and have Velcro straps that make them easy to put on and take off or adjust. Splints generally offer less support and protection than a cast, and therefore may not always be a treatment option.
- **Leg immobilizers**, to keep the knee from bending after injury or surgery. Made from foam rubber covered with fabric, leg immobilizers enclose the entire leg, fastening with Velcro straps.

Surgery

In some cases, surgery is needed to repair torn connective tissues or to realign bones with compound fractures. The vast majority of sports injuries, however, do not require surgery.

Rehabilitation (Exercise)

A key part of rehabilitation from sports injuries is a graduated exercise program designed to return the injured body part to a normal level of function.

With most injuries, early mobilization—getting the part moving as soon as possible—will speed healing. Generally, early mobilization starts with gentle range-of-motion exercises and then moves on to stretching and strengthening exercise when you can without increasing pain. For example, if you have a sprained ankle, you may be able to work on range of motion for the first day or two after the sprain by gently tracing letters with your big toe. Once your range of motion is fairly good, you can start doing gentle stretching and strengthening exercises. When you are ready, weights may be added to your exercise routine to further strengthen the injured area. The key is to avoid movement that causes pain.

As damaged tissue heals, scar tissue forms, which shrinks and brings torn or separated tissues back together. As a result, the injury site becomes tight or stiff, and damaged tissues are at risk of reinjury. That's why stretching and strengthening exercises are so important. You should continue to stretch the muscles daily and as the first part of your warmup before exercising.

When planning your rehabilitation program with a health care professional, remember that progression is the key principle. Start with just a few exercises, do them often, and then gradually increase how much you do. A complete rehabilitation program should include exercises for flexibility, endurance, and strength; instruction in balance and proper body mechanics related to the sport; and a planned return to full participation.

Throughout the rehabilitation process, avoid painful activities and concentrate on those exercises that will improve function in the injured part. Don't resume your sport until you are sure you can stretch the injured tissues without any pain, swelling, or restricted movement, and monitor any other symptoms. When you do return to your sport, start slowly and gradually build up to full participation. For more advice on how to prevent injuries as you return to active exercise,.

Rest

Although it is important to get moving as soon as possible, you must also take time to rest following an injury. All injuries need time to heal; proper rest will help the process. Your health care professional can guide you regarding the proper balance between rest and rehabilitation.

Other Therapies

Other therapies commonly used in rehabilitating sports injuries include:

- **Electrostimulation:** Mild electrical current provides pain relief by preventing nerve cells from sending pain impulses to the brain. Electrostimulation may also be used to decrease swelling, and to make muscles in immobilized limbs contract, thus preventing muscle atrophy and maintaining or increasing muscle strength.
- **Cold/cryotherapy:** Ice packs reduce inflammation by constricting blood vessels and limiting blood flow to the injured tissues. Cryotherapy eases pain by numbing the injured area. It is generally used for only the first 48 hours after injury.
- **Heat/thermotherapy:** Heat, in the form of hot compresses, heat lamps, or heating pads, causes the blood vessels to dilate and increase blood flow to the injury site. Increased blood flow aids the healing process by removing cell debris from damaged tissues and carrying healing nutrients to the injury site. Heat

also helps to reduce pain. It should not be applied within the first 48 hours after an injury.

- **Ultrasound:** High-frequency sound waves produce deep heat that is applied directly to an injured area. Ultrasound stimulates blood flow to promote healing.
- **Massage:** Manual pressing, rubbing, and manipulation soothe tense muscles and increase blood flow to the injury site.

Most of these therapies are administered or supervised by a licensed health care professional.

Who Is at Greatest Risk for Sports Injuries?

If a professional athlete dislocates a joint or tears a ligament, it makes the news. But anyone who plays sports can be injured. Three groups—children and adolescents, middle-aged athletes, and women—are particularly vulnerable.

Children and Adolescents

While playing sports can improve children's fitness, self-esteem, coordination, and self-discipline, it can also put them at risk for sports

injuries: some minor, some serious, and still others that may result in lifelong medical problems.

Young athletes are not small adults. Their bones, muscles, tendons, and ligaments are still growing and that makes them more prone to injury. Growth plates—the areas of developing cartilage where bone growth occurs in growing children—are weaker than the nearby ligaments and tendons. As a result, what is often a bruise or sprain in an adult can be a potentially serious growth-plate injury in a child. Also, a trauma that would tear a muscle or ligament in an adult would be far more likely to break a child's bone.

Because young athletes of the same age can differ greatly in size and physical maturity, some may try to perform at levels beyond their ability in order to keep up with their peers.

Adult player

More adults than ever are participating in sports. Many factors contribute to sports injuries as the body grows older. The main one is that adults may not be as agile and resilient as they were when they were younger. It is also possible that some injuries occur when a person tries to move from inactive to a more active lifestyle too quickly.

Women

More women of all ages are participating in sports than ever before. In women's sports, the action is now faster and more aggressive and powerful than in the past. As a result, women are sustaining many more injuries, and the injuries tend to be sport specific.

Children

Preventing injuries in children is a team effort, requiring the support of parents, coaches, and the kids themselves. Here's what each should do to reduce injury risk.

What parents and coaches can do:

- Try to group youngsters according to skill level and size, not by chronological age, particularly during contact sports. If this is not practical, modify the sport to accommodate the needs of children with varying skill levels.
- Match the child to the sport, and don't push the child too hard into an activity that she or he may not like or be physically capable of doing.

- Try to find sports programs where certified athletic trainers are present. These people, in addition to health care professionals, are trained to prevent, recognize, and give immediate care to sports injuries.
- See that all children get a preseason physical exam.
- Don't let (or insist that) a child play when injured. No child (or adult) should ever be allowed to work through the pain.
- Get the child medical attention if needed. A child who develops any symptom that persists or that affects athletic performance should be examined by a health care professional. Other clues that a child needs to see a health professional include inability to play following a sudden injury, visible abnormality of the arms and legs, and severe pain that prevents the use of an arm or leg.
- Provide a safe environment for sports. A poor playing field, unsafe gym sets, unsecured soccer goals, etc., can cause serious injury to children.

What children can do:

- Be in proper condition to play the sport. Get a preseason physical exam.
- Follow the rules of the game.
- Wear appropriate protective gear.
- Know how to use athletic equipment.
- Avoid playing when very tired or in pain.
- Make warmups and cooldowns part of your routine. Warmup exercises, such as stretching or light jogging, can help minimize the chances of muscle strain or other soft tissue injury. They also make the body's tissues warmer and more flexible. Cooldown exercises loosen the muscles that have tightened during exercise.

Tips for Preventing Injury

Whether you've never had a sports injury and you're trying to keep it that way or you've had an injury and don't want another, the following tips can help.

- Avoid bending knees past 90 degrees when doing half knee bends.
- Avoid twisting knees by keeping feet as flat as possible during stretches.
- When jumping, land with your knees bent.
- Do warmup exercises not just before vigorous activities like running, but also before less vigorous ones such as golf.
- Don't overdo.
- Do warmup stretches before activity. Stretch the Achilles tendon, hamstring, and quadriceps areas and hold the positions. Don't bounce.

- Cool down following vigorous sports. For example, after a race, walk or walk/jog for five minutes so your pulse comes down gradually.
- Wear properly fitting shoes that provide shock absorption and stability.
- Use the softest exercise surface available, and avoid running on hard surfaces like asphalt and concrete. Run on flat surfaces. Running uphill may increase the stress on the Achilles tendon and the leg itself.

Adult player

To prevent injuries, adult athletes should take the following precautions:

- Don't be a "weekend warrior," packing a week's worth of activity into a day or two. Try to maintain a moderate level of activity throughout the week.
- Learn to do your sport right. Using proper form can reduce your risk of "overuse" injuries such as tendinitis and stress fractures.

- Remember safety gear. Depending on the sport, this may mean knee or wrist pads or a helmet.
- Accept your body's limits. You may not be able to perform at the same level you did 10 or 20 years ago. Modify activities as necessary.
- Increase your exercise level gradually.
- Strive for a total body workout of cardiovascular, strength training, and flexibility exercises. Cross-training reduces injury while promoting total fitness.

Women

Increased emphasis on muscle strength and conditioning should be a priority for all women. Women should also be encouraged to maintain a normal body weight and avoid excessive exercise that affects the menstrual cycle. In addition, women should follow precautions listed above for other groups.

What Are Some Recent Advances in Treating Sports Injuries?

Today, the outlook for an injured player is far more optimistic than in the past. Sports medicine has developed some near-miraculous ways to help

player heal and, in most cases, return to sports. Following are some procedures that have greatly advanced the treatment of sports injuries:

Arthroscopy

Most doctors agree that the single most important advance in sports medicine has been the development of arthroscopic surgery, or arthroscopy. Arthroscopy uses a small fiberoptic scope inserted through a small incision in the skin to see inside a joint. It is primarily a diagnostic tool, allowing surgeons to view joint problems without major surgery. Depending on the problem found, surgeons may use small tools inserted through additional incisions to repair the damage, such as a torn meniscus or a torn ligament that fails to heal naturally. Using arthroscopy, for example, a surgeon may reattach the torn ends of a ligament or reconstruct the ligament by using a piece (graft) of healthy ligament from the patient or from a cadaver.

Because arthroscopy uses tiny incisions, it results in less trauma, swelling, and scar tissue than conventional surgery, which in turn decreases hospitalization and rehabilitation times. Problems can be diagnosed earlier and treated without serious health risks or more invasive procedures. Furthermore, because injuries are often addressed at an earlier stage, operations are more likely to be successful.

Tissue Engineering

When joint cartilage is damaged by an injury, it doesn't heal on its own the way other tissues do. In recent years, however, the field of sports medicine and orthopaedic surgery has begun to develop techniques such as transplantation of one's own healthy cartilage or cells to improve healing. At present, this technique is used for small cartilage defects. Questions remain about its usefulness and cost.

Targeted Pain Relief

For people with painful sports injuries, new pain-killing medicated patches can be applied directly to the injury site. The patch is an effective method of delivering pain relief, especially for many people who prefer to put their pain medication exactly where it's needed rather than throughout their entire system.

What Advances Might We Expect in the Future?

Recent advances in treating sports injuries are likely to be just the beginning. Watch for developments in these areas in the not-too-distant future:

- The need for surgery may decline as improved rehabilitation techniques lead to a more "natural" progression to recovery for more musculoskeletal injuries.
- Technical advances and new imaging methods will lead to better ways to diagnose and treat injuries.
- Scientists will gain a better understanding of the role of nutrition in inflammation and healing. Such knowledge could lead to improvements in treatment.
- Tissue engineering will become more commonplace. Early studies of cartilage tissue engineering are now underway.
- Using gene therapy, doctors may be able to modify particular cells to induce repair of injured tissues.