

Sports Medicine Injury Prevention

Adapted From Utah Sports Medicine Curriculum

OBJECTIVES/RATIONALE

The best method of managing and caring for athletic injuries is to prevent them from occurring. Many factors are important in the prevention of athletic injuries. The student will recognize types of protective equipment and demonstrate the theory and principles of prophylactic taping and bracing.

TEKS 121.4 1I, 6D, 11A, 13A, 13B, 16A, 16,

TAKS ELA 1
Science 5

KEY POINTS

- I. Protective Equipment
 - A. The proper selection and fit of protective equipment is essential in the prevention of injuries.
 - B. Protective equipment in sports should be designed to prevent injury and to protect injured parts against further injury.
 - C. The ideal protective equipment causes minimal functional interference and is not harmful to other participants.
 - D. Practicality dictates that protective equipment be simple to fit and maintain, be durable and reliable, and not be prohibitively expensive.
 - E. Modifications and improvements in sports equipment are continually being made, especially for sports in which injury is common.
 - F. The hazards demonstrated in each individual sport dictate the need for specific types of protection.
 - G. Protective equipment can be abused either by players who use the equipment as a weapon against their opponent, or by players who take dangerous risks and rely on the equipment to protect them.
- II. Legal Concerns
 - A. As in other aspects of sports participation, there is increasing litigation related to equipment. Manufacturers and purchasers of sports equipment must foresee all possible uses and misuses of the equipment and must warn the user of any potential risks inherent in the use or misuse of that equipment.
 - B. To decrease the possibilities of sports injuries and litigation stemming from the equipment:
 - 1. Buy protective equipment from reputable manufacturers.
 - 2. Buy the safest equipment resources permit.
 - 3. Ensure that all equipment is assembled correctly – follow the manufacturer’s instructions to the letter.

4. Maintain all equipment properly – follow the manufacturer’s guidelines.
 5. Use equipment only for the purpose for which it was designed.
 6. Warn athletes who use the equipment about all possible risks that using the equipment could entail.
 7. Use great caution in the customizing of any piece of equipment.
 8. Use no defective equipment.
- III. Selection and Fitting of Protective Equipment
- A. Correctly fitting equipment is of the utmost importance for injury prevention and protection.
 - B. To fit athletic equipment correctly, the following factors should be considered:
 1. Size – athletic equipment that is too small or large for an athlete does not offer adequate protection.
 2. Sport and Position – equipment for certain sports is designed for the demands of a specific position. Individual needs should be evaluated closely in selecting equipment for a specific sport position.
 3. Strength – evaluating an athlete’s strength will further determine what size of equipment should be used. If the equipment is too small or restrictive, the athlete could be compromised.
 4. Age and Physical Development – a wide array of equipment is manufactured for athletes of different ages and developmental stages.
 5. Skill Levels – some equipment is manufactured to adapt to different skill levels. Equipment for the professional athlete may not be suitable for the amateur athlete.
- IV. Design of Protective Equipment
- A. The following four basic principles are used in protective equipment design:
 1. Channeling – forces are channeled away from anatomical structures.
 2. Dispersion – forces are dispersed over a large area.
 3. Mechanical Structuring – forces are reduced through the use of a mechanical structure.
 4. Restriction – anatomical ranges of motion are reduced to prevent forces that cause injury.
- V. Head Protection
- A. Effective protection for the head has improved and expanded significantly in recent years.
 - B. Head protection is advised and often mandated in sports such as football, ice hockey, lacrosse, boxing, baseball, cycling, and automobile and motorcycle racing.
 - C. Nothing can eliminate the possibility of a head injury, however, helmets do appear to significantly lessen their severity.

- D. Helmets should be able to absorb force levels high enough to fracture the skull.
- E. Helmet fit should be monitored often because the fit can be altered by factors such as environmental temperature, hair length, deterioration of internal padding, loss of air from cells, and spread of the facemask.
- F. A major influence on football helmet standardization in the United States has been the National Operating Committee on Standards for Athletic Equipment (NOCSAE).
 - 1. To be NOCSAE approved, a helmet must be able to tolerate forces applied to many different areas of it. Football helmets must withstand repeated blows and high-mass-low-velocity impacts such as running into a goal post or hitting the ground with the head.
 - 2. All helmets must have a NOCSAE certification. Even though a helmet is certified does not mean that it is completely fail-safe.
 - 3. The following warning is placed on all football helmets:
 - a. "Do not use this helmet to butt, ram or spear an opposing player. This is a violation of football rules, and can result in severe head, brain, neck injury, paralysis, or death to you and possible injury to your opponent. There is a risk these injuries may also occur as a result of accidental contact without intention to butt, ram, or spear. No helmet can prevent all such injuries."
- G. Ice Hockey helmets must be able to spread impacts over a large surface area through a firm exterior shell and be able to decelerate forces that act on the head through an energy-absorbing liner.
- H. Baseball batting helmets must withstand high-velocity impacts. Helmets with an ear-flap can afford some additional protection to the batter.

VI. Face Protection

- A. Devices that provide face protection fall into four categories.
 - 1. Full face guards
 - a. Face guards are used in a variety of sports to protect against flying or carried objects during a collision with another player.
 - b. A great variety of face masks and bars are available to athletes, depending on the position played and the protection needed.
 - 2. Mouth guards
 - a. The majority of dental trauma can be prevented if the athlete wears a correctly fitted intra-oral mouth guard.
 - b. In addition to protecting the teeth, the intra-oral mouth guard absorbs the shock of chin blows and helps to prevent concussions.

- c. A mouth protector should fit properly and provide comfort, unrestricted breathing and unimpeded speech during competition.
 - d. It is best when the mouthpiece is retained by the upper teeth.
3. Ear guards - with the exception of boxing and wrestling, most contact sports do not make a special practice of protecting the ears
 4. Eye protection devices
 - a. It is essential that athletes take special precautions to protect their eyes, especially in those sports that use fast-moving projectiles and implements.
 - b. The athlete who wears corrective lenses must also be protected during sports. Glasses can be broken during competition and can pose considerable danger.
 - c. The eyes of the athlete can be protected by glass guards, case-hardened lenses, plastic lenses.

VII. Trunk and Thorax Protection

- A. Trunk and thorax protection is essential in many contact and collision sports. Areas that are most exposed to impact forces must be properly covered with some material that offers protection against soft-tissue compression.
- B. Of particular concern are the exposed bony protuberances of the body that have insufficient soft tissue for protection such as shoulders, ribs, and spine, as well as external genitalia.
- C. Shoulder Pads and Restraints
 1. The shoulder girdle should be protected against forceful contact with opponents and hard surfaces and objects.
 2. There are two types of shoulder pads used today: flat and cantilevered.
 3. The ribs and thorax may be protected by commercially available "flak jackets". Football running backs who are exposed to repeated thoracic contusion or quarterbacks with prior rib cage injury may derive significant benefit from padding of this type.
 4. The shoulder braces used in sports are essentially restraining devices for the chronically dislocated shoulder. Their purpose is to restrict the upper arm from being abducted more than 90 degrees and externally rotated, thus preventing it from being placed in a vulnerable position.
- D. Breast Support
 1. A variety of sports bras are available today which help to protect the breasts against movement that stems from running and jumping.
 2. These bras hold the breasts to the chest and prevent stretching of ligaments.
- E. Groin and Genitalia - Sports involving high-velocity projectiles require cup protection for male participants.

F. Other Padding and Braces

1. Pads in the hip region are often needed in collision and high-velocity sports such as hockey and football.
2. Abdominal and low back supports are designed to give relief from low back strains.

VIII. Limb Protection

A. Limbs, as with other areas of the body, can be exposed a great deal to sports injuries and can require protection or, where there is a weakness, support. Compression and mild soft-tissue support can be provided by neoprene sleeves, and hard bony areas of the body can be protected by commercial pads.

B. Footwear

1. Socks – Poorly fitted socks can cause abnormal stresses on the foot. All athletic socks should be clean, dry and without holes to avoid irritations.
2. Shoes – Even more damaging than improperly fitted socks are improperly fitted shoes. Chronic abnormal pressures to the foot can often cause permanent structural deformities, as well as potential dangerous calluses and blisters. Improperly fitted shoes can also result in mechanical disturbances that affect the body's total postural balance, and may result in problems with the joints and muscles.

a. The bare human foot was designed to function on uneven surfaces.

- i. a person's left foot generally varies in size and shape from the right foot.
- ii. It is important to measure both feet.
- iii. Shoes should be selected for the longer of the two measurements.
- iv. To fit the sports shoe properly, the athlete should simulate the conditions under which they will perform with the shoes on.
- v. It is ideal to fit the shoes at the end of the day to accommodate the gradual increase in size that occurs during the course of the day.

b. A shoe with cleats presents some additional problems in fitting. No matter which sport is being played, the cleats must be properly positioned under the two weight-bearing joints and must not be felt through the soles of the shoes.

C. Foot Pads – Pads and custom-made foot orthotics may be helpful in treating a variety of foot problems, as well as other lower extremity problems involving the hip and knee. Commercial foot pads are intended for use by the general public and are not usually designed to withstand the rigors of sports activities.

- D. Shin and Lower Leg – commercially marketed hard-shelled, molded shin guards are used in contact and collision type sports such as field hockey and soccer.
- E. Thigh and Upper Leg – thigh and upper leg protection is necessary in collision type sports such as hockey and football. Generally, pads slip into ready-made pockets in the uniform.
- F. Knee Supports – elastic knee pads or guards are extremely valuable in sports in which the athlete falls or receives a direct blow to the anterior aspect of the knee. An elastic sleeve may help to dissipate an anterior striking force but fails to protect the knee against lateral, medial, or twisting forces.
- G. Ankle Supports – many effective commercial supports exist as an alternative to ankle taping.
- H. Hand, Wrist, Arm and Elbow Protection – the hand is an often neglected area of the body in sports and special attention must be paid to protecting the integrity of the hand when encountering high-speed projectiles. Padded gloves, mitts, and boxing gloves are part of the standard equipment for many sports. The arm and elbow can be protected in any sport by commercial padding or by customized protective padding.

IX. Braces

- A. The effectiveness of prophylactic (to prevent or avoid) knee braces is controversial. Such bracing has become increasingly popular in high school, college and professional football.
 1. The braces are used by players who are at greatest risk – offensive and defensive lineman, linebackers, and tight ends.
 2. There are a number of different knee braces on the market. Knee braces are designed to provide protection against lateral and medial, but not rotary forces.
 3. The braces vary depending on the manufacturer, but commonly consist of a single-sided strut made of metal or heavy plastic, having a dual axis with a dual hinge.
- B. Following serious knee joint injury that produces chronic instability or necessitates surgery, a functional, customized orthopedic knee brace may be prescribed for the athlete.

X. Taping

- A. Taping and bandaging are important techniques used for the care of injuries and the protection of the athlete.
- B. When used for sports injuries, adhesive tape offers a number of possibilities.
 1. Retention of wound dressings.
 2. Stabilization of compression-type bandages that are used to control bleeding.
 3. Support of recent injuries to prevent additional insult that might result from the activities of the athlete.
 4. Protecting against acute injuries. This can be achieved by limiting the motion of a body part or by securing some special device.

C. General Guidelines

1. Be sure the area is dry, clean, and free of body hair, prewrapping may eliminate the need for shaving.
2. Use some form of tape adherent to ensure bonding of the tape to the skin. If prewrap is used, one layer should be applied over the tape adherent. Prewrap helps to protect the skin but decreases the efficiency of the tape.
3. In areas with potential for friction blisters or burns, apply a lubricated pad. Cuts, blisters, and rashes should be covered with a clean non-stick pad prior to the use of adherent or tape.
4. Overlap each strip of tape to the previous strip of tape by half. Avoid spaces between tape segments, as such spaces may result in blistering.
5. Smooth and mold the tape on the natural contour of the area being taped.
6. Try to make the athlete comfortable but maintain the extremity in the correct position while it is being taped.
7. After any wrapping or taping, the athlete should be checked for comfort as well as signs of impaired circulation (numbness, tingling, discoloration, or loss of pulse).

D. Tape Usage

1. Tape is available in a variety of widths. Tapes vary in strength and elasticity.
2. Tape should adhere readily when applied and should maintain this adherence despite profuse perspiration and activity.
3. Stretch or elastic tape is used for the smaller, more angular body parts such as the feet, hands, wrist and fingers. It is often used in combination with linen tape.
4. Tape should be stored in a cool place, as high temperatures (greater than 75 degrees) may alter the adhesive ability. The tape should be stacked so that it rests flat to avoid distortion.
5. Most non-elastic tape and some elastic tape can be hand torn.
 - a. To tear tape, hold firmly on each side of the proposed tear line. Pull the free end away at an angle so that the force crosses the lines of the fabric at a sharp angle.
 - b. When tape is properly torn, the edges should be straight, with no loose threads.
6. Special cutters are made for tape removal. Avoid cutting over bony prominences. Be careful to look for blisters or other skin irritation as the tape is removed.

E. Effectiveness of Taping

1. The effectiveness of taping for prevention and treatment of injury has been a matter of controversy for many years.
2. Ankle taping to prevent injury should only be used in conjunction with proper exercise. Athletes with normal or near normal ankles should rely more on strengthening exercises than taping or bracing.

3. An improperly applied wrap or tape can compound an injury and may even create postural imbalances that can adversely affect other parts of the body.
4. Arguments against taping include the following.
 - a. Tape usually becomes loose with wear.
 - b. Because the skin is mobile, taping cannot be effective.
 - c. Taping the ankle weakens the leg muscles.
 - d. Moisture develops between the skin and tape, thus affecting the adherence of the tape.
 - e. Tape tears under stress.
5. Despite these arguments, most studies agree that taping does contribute to a lower incidence of injury and reinjury.
 - a. Studies have also shown that prophylactic ankle taping is superior to lace-on braces for the first 20 minutes. After 20 minutes, taping is equal to bracing in its ability to support the ankle.

F. Complications of Taping

1. Possible complications with tape use include:
 - a. Skin allergies.
 - b. Skin irritations.
 - c. Blisters.
 - d. Lacerations.
 - e. Reactions to tape adherent.
2. Skin irritations commonly develop with prolonged use of taping over a sport season. Usually these irritations are minor. Proper daily cleansing of the area that has been taped can sometimes prevent irritation.
3. Improper application techniques can result in blisters or small skin lacerations.

XI. Common Taping Procedures

A. Routine Non-Injury Ankle Taping

1. The athlete should sit on a table with the leg extended, the lower third of the calf extended past the edge of the table and the foot held at a 90 degree angle in dorsiflexion. The taper faces the plantar aspect of the athlete's foot.
2. Apply a coating of tape adherent to protect the skin and offer an adhering base.
3. Make sure that the ankle surface is cleaned of dirt and oil and apply a prewrap material (or tape directly to the skin).
4. Apply a foam pad over the instep and to the back of the heel.
5. Using 1 ½ inch tape, a single anchor is placed around the ankle approximately 5-6 inches above the malleolus.
6. An anchor can also be placed at the distal third of the longitudinal arch. Make sure that the base of the fifth metatarsal is not constricted.

7. Two to three stirrups are applied in consecutive order beginning on the medial part of the calf and pulling up on the lateral aspect of the leg with moderate tension. This direction of application results in slight eversion of the foot, thus counteracting the common inversion sprain.
8. Circular strips are applied from the point of the proximal anchor, moving downward until the malleolus is completely covered.
9. Next, arch strips are applied down to the distal anchor.
10. The final support is given by a heel lock. A simple method is to start high on the instep, bring the tape along the ankle at a slight angle, hooking the heel, leading under the arch, then coming up on the opposite side, and finishing at the starting point. At this point the tape is torn to complete half of the heel lock. To complete the remaining half, execute the same procedure on the opposite side of the ankle.
11. You may then choose to cover the ankle again with a second layer of tape. This will hold the other components in place. Begin at the bottom of the stirrups and encase the entire area upward to the proximal anchor.

B. Prophylactic Thumb Taping

1. This taping technique is designed to protect the joints of the thumb as well as the surrounding muscles.
2. The athlete should fully extend and adduct the fingers while keeping the thumb in a relaxed, neutral position (as if holding a can). The taper should stand in front of the athlete's thumb.
3. Apply prewrap to the forearm, wrist and thumb.
4. Using 1 inch tape, place an anchor strip around the wrist and another around the distal end of the thumb.
5. From the anchor at the tip of the thumb to the anchor around the wrist, apply four strips in a series on the dorsal side of the thumb.
6. Hold these strips in place by applying one locking strip around the wrist and one encircling the tip of the thumb.
7. Next add a series of three "spica" strips. The first spica is started on the radial side at the base of the thumb and carried under the thumb, completely encircling it, and then crossing to the starting point. The strip should continue around the wrist and finish at the starting point. Each of the following spica strips should overlap the preceding strip by at least 2/3 inch and move downward on the thumb.
8. Place a final locking strip around the wrist.

C. Elbow Hyperextension Taping

1. The athlete should stand with the elbow flexed at least 30-45 degrees and the forearm in a neutral position.
2. The taper should stand facing the arm.
3. Apply adhesive spray to the area, and apply prewrap from the mid-humerus to the mid-forearm.

4. Apply two anchor strips loosely around the arm, approximately 2-3 inches above and below the elbow joint.
5. Construct a checkrein by placing a 4 inch strip of tape against the center of a 10 inch strip of tape, thereby “blanking out” the center portion of the longer strip. Place the checkrein so that it spans the two anchor strips, with the blanked-out side facing downward.
6. Place five additional 10 inch strips of tape over the first checkrein (tape fan).
7. Finish the procedure by securing the checkrein with three locking strips both above and below the elbow joint.
8. A figure-8 elastic wrap can be added over the taping to prevent the tape from slipping because of perspiration.

XII. Other Aspects of Injury Prevention

A. Coaching Techniques

1. The sports medicine professional must remember their ethical and legal responsibilities to each athlete they work with.
 - a. The athlete’s welfare should be placed above all other considerations, including pressure from coaches, administration, and parents.
 - b. The sports medicine professional may occasionally find unsafe coaching practices or facilities. Should this occur, the appropriate person should be notified first. If the advice is ignored at that level, a report of the findings and recommendations should be made to the highest authority available.
 - c. Treat every athlete equally.
 - d. Be loyal to the coaches, team, physicians, and other sports medicine professionals.
2. The coach is responsible for teaching playing skills.
 - a. All coaches should insist on skill techniques that minimize risks.
 - b. The coach must also provide, or delegate to an appropriate person, emergency care of athletic injuries and application of first aid in the absence of a sports medicine professional.

B. Body Mechanics

1. More than half the total body weight is located in the upper part of the body, and this weight is supported by thin bones. The center of gravity, which increases stability as it is lowered, is relatively high in the erect human body. Despite the seemingly inefficiencies, the body can compensate by making modifications or adjustments that depend on the task at hand.
2. In the upright posture, human legs are long and straight, and the feet are adaptable for support and locomotion. The spine has three curves that help maintain balance. The head, weighing close to 14 pounds, is balanced precariously on top of seven small cervical vertebrae. This cervical area is particularly vulnerable to injury.

Therefore, strengthening the neck muscles is an important protective measure for sports.

3. When determining the mechanical reasons for sports injuries to the musculoskeletal system, many factors stand out. Heredity, congenital, or acquired defects may predispose an athlete to a specific type of injury.

ACTIVITIES

- I. Demonstrate proper fitting guidelines for certain equipment, such as,
Head Protection – helmets
Face Protection – face guards, mouth guards, ear guards, eye protection
Trunk & Thorax Protection – shoulder pads, other padding,
Footwear – socks, various shoes, foot pads, orthotics, shin guards, knee supports, ankle supports, hand/wrist/arm/elbow pads
- II. Demonstrate proper procedure for the following:
tape an ankle using the standard prophylactic taping method.
Tape a thumb using the standard prophylactic taping method.
Tape an elbow hyper-extension using the standard prophylactic taping method

MATERIALS NEEDED

Quiz – Key

HOSA – Sports Medicine

Various protective equipment

Various widths – adhesive tape

Stretch or elastic tape

Surgical scissors

ASSESSMENT

Quiz

ACCOMMODATIONS

For reinforcement, the student will identify protective equipment and the injuries the equipment helps to prevent.

For enrichment, the student will develop a new protective device for use in a sport.

REFLECTIONS

QUIZ

1. Preseason football camp has just begun. List five guidelines that should be followed to decrease the possibilities of sports injuries and litigation stemming from the sports equipment:
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.

2. List the five factors that should be considered when fitting athletic equipment correctly:
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.

3. T F The best method of managing and caring for athletic injuries is to prevent them from occurring.

4. T F If worn properly, football helmets can completely eliminate the possibility of head injuries.

5. T F The majority of dental traumas can be prevented if the athlete wears a correctly fitted mouthpiece.

6. In what types of athletic events should an athlete wear eye protection:

7. T F Only athletes with a history of eye injuries should wear eye guards.

8. T F Improperly fitted shoes can lead to mechanical disturbances that can affect the entire body.

9. All football helmets should be approved by _____.

10. Discuss the importance of the warning placed on all football helmets:

11. An athlete approaches you concerning how to purchase a pair of athletic shoes. She reports having high arches and is a tennis team member. What guidelines will you suggest for this athlete?

1.

2.

3.

4.

QUIZ - KEY

1. Preseason football camp has just begun. List five guidelines that should be followed to decrease the possibilities of sports injuries and litigation stemming from the sports equipment:
 - **Buy from reputable manufacturers**
 - **Buy safest equipment resources permit**
 - **Ensure that equipment is assembled correctly**
 - **Maintain equipment properly**
 - **Use equipment only for purpose it was designed**
 - **Warn athletes about risks of using equipment**
 - **Use caution when customizing**
 - **Use no defective equipment**

2. List the five factors that should be considered when fitting athletic equipment correctly:
 1. **Size**
 2. **Sport & Position**
 3. **Strength**
 4. **Age & Physical Development**
 5. **Skill Level**

3. **T F** The best method of managing and caring for athletic injuries is to prevent them from occurring.

4. **T F** If worn properly, football helmets can completely eliminate the possibility of head injuries.

5. **T F** The majority of dental traumas can be prevented if the athlete wears a correctly fitted mouthpiece.

6. In what types of athletic events should an athlete wear eye protection:
Fast moving with projectile objects

7. **T F** Only athletes with a history of eye injuries should wear eye guards.

8. **T F** Improperly fitted shoes can lead to mechanical disturbances that can affect the entire body.

9. All football helmets should be approved by _____ **NOCSAE** _____.
10. Discuss the importance of the warning placed on all football helmets:
- **Use only for intended purpose**
 - **Follow rules of sport**
 - **No helmet can protect from all injuries**
 - **User assumes risk**
11. An athlete approaches you concerning how to purchase a pair of athletic shoes. She reports having high arches and is a tennis team member. What guidelines will you suggest for this athlete?
- **Simulate conditions with shoes on**
 - **Fit at end of day**
 - **Measure both feet**
 - **Sport specific shoes**
 - **Good arch supports**
 - **Purchase from reputable store**