Objective 1: Describe the basic principles and specialized equipment used in the prevention of athletic injury.

a. Recognize types and functions of protective equipment.
   1. Helmet / face mask / eye protection / ear guards
   2. Mouth guards
   3. Neck collars
   4. Padding
   5. Sports bras
   6. Athletic supporter / cup
   7. Shin guards
   8. Shoe
   9. Other sport specific protection devices

b. Discuss the legal ramifications of manufacturing, buying, and issuing equipment.
   1. NOCSAE warning
   2. Modification of equipment
   3. Proper fit and selection
   4. Use of defective or worn out equipment
Basic principles in the prevention of athletic injury

- 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.
  - Proper fit and selection.
  - Design
    - To prevent injury
    - To protect injured parts from further injury.
- Practicality dictates that protective equipment should be:
  - Simple to fit and maintain.
  - Be durable and reliable.
  - Not be extremely expensive.
  - Minimal functional interference
Basic principles in the prevention of athletic injury

• Protective equipment can be abused
  – By players who use the equipment as a weapon against their opponent,
  – By players who take dangerous risks and rely on the equipment to protect them.

• Modifications and improvements in sports equipment are continually being made, especially for sports in which injury is common.

• Hazards demonstrated in each individual sport dictate the need for specific types of protection.
  – In collision contact sports, exposed and vulnerable areas must be protected from impact with the surface or other players.
  – Vital areas such as the head, neck, kidneys and genitalia must have priority for protection.
  – Padding must also protect primary contact points
  – High velocity hazards are seen in sports that use a type of projectile such as balls or pucks.
  – Dental protection such as mouth guards prevent dental injuries and may help to decrease impact causing concussions.
Various types and functions of protective equipment.
Helmets

- Mandated in sports such as football, ice hockey, lacrosse, boxing, baseball, cycling, and automobile and motorcycle racing, etc.
Helmets

• Improperly fitted helmet increases the opportunity for head injuries.

• Spread high-velocity impacts over a large surface area through a firm exterior shell and decelerate forces that act on the head through an energy-absorbing liner.

• Fit can be altered by:
  – Temperature
  – Hair length
  – Deterioration of internal padding
  – Loss of air (Air bladder helmet)

• Nothing can eliminate the possibility of a head injury; however, helmets do significantly lessen their severity.

• Ear-flaps provide additional protection to the ears and lower portions of the skull.
Face Masks

- Used in a variety of sports to protect against flying or carried objects during a collision with another player.
Face Masks

• A large variety of face masks styles are available, depending on the position played and the protection needed.

• In several sports, the addition of a face mask to a helmet is now more widely used.
Eye Protection

- Essential in those sports that are fast-moving and use projectiles or implements.
- Glasses pose considerable danger during competition.
- Glasses may:
  - Bend or break
  - Slip on sweat
  - Fog from perspiration
  - Detract from peripheral vision
  - Be difficult to wear with protective headgear.
- The following items can protect the eyes of an athlete:
  - Glass guards
  - Case-hardened or plastic lenses
Ear Guards

Essential in the following sport to help limit the amount of rubbing and friction that causes injury

- Boxing
- Wrestling
- Rugby
- Water polo
Irritation of the ears can occur to the point that permanent deformity can ensue. Some of these injuries may include:

- Cauliflower-ear
- Lacerations
- Ruptured eardrum

To avoid these problems, special ear guards should be routinely worn.
Mouth Guards

Correctly fitted mouth guard prevents the majority of dental trauma.

• Fit should be:
  – Tight fit
  – Be comfortable
  – Unrestricted breathing
  – Should not impede speech during competition.

• Fit is best when retained on the upper jaw and projects backward only as far as the last molar.

• Composed of a flexible, resilient material.
Mouth Guards

- In addition to protecting the teeth, the intra-oral mouth guard absorbs shock and helps to prevent concussions.

More than a mouthful

An athlete who does not wear a mouthguard can be susceptible to a concussion or jaw injury. A properly fitted mouthguard can cushion a blow to the mouth area and prevent those types of injuries.

How a concussion occurs:

1. The unprotected athlete takes a direct hit to the chin.
2. The impact forces the lower jaw (mandible) upward.
3. The end of the lower jaw (condyle) hits the base of the skull (socket) causing the brain to move which results in a concussion.

- Socket
- Condyle: End of jaw
- Connective tissue: Can stretch or tear when joint is injured
- Mandible: Lower jaw
Neck Collars

Used by players in collision contact sports to reduce extreme backward or lateral bending.

• Also known as a:
  – Neck roll
  – Cowboy collar
  – Butterfly restrictor

• Made from a variety of different materials
  – Foam
  – Plastic

• Generally fastened about the athletes shoulder pad around the rear and sides of a player’s neck.

• Prevents lateral bending as well as extension and may give some protection against axial compression.
Shoulder Pads

- Protect against forceful contact with opponents and other hard surfaces.
- Impact force is spread over a large surface area of the exterior shell and then distributed into an energy-absorbing design composed of a plastic hull having resilient padding attached to the inside.

- This Convex-shape and cantilever design offers protection to the wearer's shoulders and upper chest and back.

- Offers no protection to the athlete’s ribs or sides between the arms and the waist.
Flipper pads allow full upward arm mobility & additional protection for extended arms (attached with hook & loop fasteners for easy removal)

Coated web straps for maximum durability

Wrap-around snubbers allow full range of movement while preventing epaulet collapse

Hinged deltoid pads provide additional protection & allow full range of arm movement

Adjustable padding system provides a custom fit

1.5" elastic strap allows fine-tuning of fit

1.5" coated belts maintain shape of pad on impact to prevent collapse, buckles covered with web straps

Cool-fit, triple density pad system incorporates lightweight waffle foam with air channels to provide protection and comfort

1.5" coated belts maintain shape of pad on impact to prevent collapse, buckles covered with web straps

Front SHOCK STABILIZER disperses pressure from frontal impacts away from sternum

DRI-GEAR Moisture Wicking, BioFresh anti-microbial lining system

High impact P.E. shell
Athletes who are exposed to repeated thoracic contusion or with prior rib cage injury benefit from rib and back pads

- Pads are also used in other regions of the body
  - Hips
  - Tailbone (sacral/coccyx)
  - Thighs
  - Knees

- These pads are often needed in collision and high-velocity sports.

- Padding must be varied in structure, weight, and application according to the sport and size of the athlete for which it is used.
Sports Bras

• Designed to provide support to women's breasts and minimize movement while exercising or playing sports.

• Motion is difficult to reduce without a sports bra because the ligaments in the breasts do not contain strong structural support.

• Females, who play sports or exercise and do not wear a sports bra, put themselves at risk of causing irreversible damage to ligaments in the breasts.
Athletic Supporter

• Consists of an elastic waistband and leg straps which connect to a pouch designed to support the male genitals as well as keep a protective cup in place.

• It was believed that athletic supporters helped to protect from inguinal hernias
  – When a portion of the intestines descends through the canal that contains the spermatic cord.
  – However athletic supporters have been shown to offer no protection against this relatively common injury.
Some athletes have moved away from the traditional athletic supporter into a more complete and supportive compression short or girdle.

- These devices allow for more support to the entire groin and hip joint as well as provide pockets for protective cup and pads.

Sports involving high-velocity projectiles require that athletes wear a proactive cup, usually made of a hard plastic with perforations for ventilation.

- A more flexible, soft cup is also offered for low contact sports or female athletes.
Shin Guards

• Hard-shelled device made of many differing synthetic materials, including: fiberglass or polyurethane with a foam rubber under lining.

• Commercially marketed equipment worn in front of the shins (Lower leg over the tibia bone) to protect against a large range of leg injuries.

• Commonly used in:
  – Soccer
  – Rugby
  – Baseball (Batters & Catchers)
  – Hockey
  – Other sports where it is deemed necessary
Shoes

• The human foot was designed to function on uneven surfaces.
• Shoes were created to protect against harmful surfaces, but they should never interfere with normal functioning.

• Improperly fitted shoes can result in
  – Mechanical disturbances that affect the body’s total postural balance.
  – Problems with the joints and muscles.
  – Chronic abnormal pressures to the foot can often cause permanent structural deformities.
  – Potential dangerous calluses and blisters.
Fitting sports footwear can be difficult

- It is important to measure both feet.
  - A person’s left foot generally varies in size and shape from the right foot.
  - Shoes should be selected for the longer of the two measurements.
  - The shoe should be long enough that all toes can be fully extended without being cramped.
  - The athlete should simulate the conditions under which they will perform with the shoes on.
    - 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.

- Each sport places unique stresses and performance demands on the foot
  - Footwear can mean the difference between success, failure, or injury in competition.
  - A shoe with cleats presents some additional problems in fitting.
    - Cleats must be properly positioned under the two weight-bearing joints and must not be felt through the soles of the shoes.
Other Footwear

• All athletic socks should be clean, dry and without holes to avoid irritations.
  – Poorly fitted socks can cause abnormal stresses on the 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 orthotics and insoles are not usually designed to withstand the rigors of sports activities.
    • Generally not durable enough for long and hard extended use.
  – Custom-made orthotics are fabricated from a variety of materials such as foam, felt, plaster, or aluminum.
    • Customized to the individuals natural curvature of each foot.
Footminders® Orthotic Technology: biomechanical support and cushioning!

- Deep heel cup for ankle stability
- High arch for extra support
- Metatarsal raise to relieve ball of foot pain
- Anti-bacterial, moisture-absorbing top fabric to keep feet fresh and dry
- Dual Layer Orthotic Technology for support and cushioning
- Heel "Shock Pad" made of shock-absorbing Duraspanex® material

**ARCH TYPE ➔ ALIGNMENT ➔ SHOE TYPE**

- **STABILITY SHOE**
  - normal arch
  - neutral

- **CUSHIONED SHOE**
  - high arch
  - supinator

- **MOTION CONTROL SHOE**
  - flatfoot
  - pronator

**Fig. 3**

- Increased Sway Back
- Pelvis Drops
- Shortened Leg
- Hyper-Extended Knees
- Flat Feet
- Corrected Foot with Orthotic
There are many specific devices designed to protect athletes.

- Padded gloves, mitts, and boxing gloves
  - Designed to protect the hand which is an often neglected area of the body in sports and particular attention must be paid to protecting the integrity of the hand when encountering high-speed projectiles.
Legal ramifications of manufacturing, buying, and issuing equipment.
Legal Concerns

- As in other aspects of sports participation, there is increasing litigation related to legal ramifications of manufacturing, buying, and issuing of 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.

- To decrease the possibilities of sports injuries and litigation stemming from the equipment:
  - Buy protective equipment from reputable manufacturers.
  - Buy the safest equipment resources permit.
  - Ensure that all equipment is assembled correctly – follow the manufacturer’s instructions to the letter.
  - Maintain all equipment properly – follow the manufacturer’s guidelines.
  - Use equipment only for the purpose for which it was designed.
  - Warn athletes who use the equipment about all possible risks that using the equipment could entail.
  - Use great caution in the customizing of any piece of equipment.
  - Use no defective equipment.
A major influence on standardization of productive equipment in the United States has been the National Operating Committee on Standards for Athletic Equipment (NOCSAE).

To be NOCSAE approved, protective equipment 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.
- All helmets must have a NOCSAE certification.
- Even though a helmet is certified does not mean that it is completely fail-safe.
NOCSAE Warning

**WARNING** - NO HELMET CAN PREVENT ALL HEAD OR NECK INJURIES A PLAYER MIGHT RECEIVE WHILE PARTICIPATING IN FOOTBALL. DO NOT USE THIS HELMET TO BUTT, RAM OR SPEAR AN OPPOSING PLAYER. THIS IS IN VIOLATION OF THE FOOTBALL RULES AND SUCH USE CAN RESULT IN SERIOUS HEAD OR NECK INJURIES, PARALYSIS OR DEATH TO YOU AND POSSIBLE INJURY TO YOUR OPPONENT.
Modifications and improvements in sports equipment are continually being made by manufacturers to insure the safety of the athlete.

Alteration of sports equipment by an athlete or someone other than the manufacturer could result in the loss of the manufacturer's warranty of that product.
Modification of Equipment

• Any modification of equipment will void any legal liability the manufacturer would have as a result of failure of the product.

  – If one were to drill a hole in a piece of plastic material and the material later failed, the manufacturer would have every right to suggest that the drilling altered the structure of the material and caused the failure.

• Liability resulting from the improper care or modification of manufactured products is separate from manufacturer's liability.

• Only equipment that is unaltered and regularly inspected and reconditioned can be considered within the scope of the manufacturer's responsibility.
Proper fit and selection

- Correctly fitting equipment is of the utmost importance for injury prevention and protection.
- Standards of correct fit are set and should be adhered to.
  - To fit athletic equipment correctly, the following factors should be considered:
    - Size (of Athlete and Equipment)
    - Sport and Position
    - Strength (of Athlete and Equipment)
    - Age and Physical Development.
Use of defective or worn out equipment

- Routine inspection of protective equipment and their parts is very important to the safety of the athlete.

- Observe for:
  - Parts that can wear down
  - Cracked or broken
  - Missing parts or pieces
  - Frayed, torn or faded

- Daily, weekly and seasonal inspections as well as repairs, refurbishing and replacement of protective equipment is important and could prevent an injury.
Objective 3: Identify principles of protective bracing.

A. Discuss the differences between functional and prophylactic bracing.

B. Identify the function of joint sleeves (compression).
Functional and Prophylactic Bracing

• The effectiveness of prophylactic (to prevent or avoid) braces is controversial.
  – To date, studies are divided, with some indicating a decrease in knee injuries and others reporting no difference or an increase in injuries.

• Braces are used by players who are at a greatest risk of being injured due to:
  – Position or sport being played
  – Previous injury
Functional and Prophylactic Bracing

- There are a number of different braces and manufactures on the market.

- 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.
Functional and Prophylactic Bracing

• Following serious joint injury that produces chronic instability or necessitates surgery, a functional, customized orthopedic brace may be prescribed for the athlete.
  – These functional braces are designed to prevent re-injury in athletes with prior injury.
  – The effectiveness of these braces has been better documented than that for prophylactic braces.
Joint & Compression Sleeves

- Joint sleeve or compression sleeves provide mild soft-tissue support, and to some extent, retain body heat and help to reduce edema caused by tissue compression.

- Pads or guards may be added that protect the athlete from falls or a direct blow to a joint.

- Joint sleeves may help to dissipate an anterior striking force but fails to protect the joint against lateral, medial, hyperextension or twisting forces.

- Sleeves are generally composed of elastic or neoprene material.