**CORE STRANDS and Standards**

STRAND 7 Students will explore specific sports injuries of the lower extremities and apply athletic injury prevention principles.

* 1. Review the anatomy of the lower extremities.
     + Bones
       - Femur
       - Tibia
       - Fibula
       - Patella
       - Talus
       - Calcaneus
       - Metatarsals
       - Phalanges
     + Joints
       - Tibial Femoral
       - Patello Femoral
       - Talocrural
       - Subtalar
       - Midfoot
       - MP
       - PIP/DIP
     + Soft Tissues
       - Patellar Tendon
       - ACL
       - MCL
       - PCL
       - LCL
       - Lateral and Medial Meniscus
       - Anterior Talofibular ligament (ATF)
       - Anterior Tibiofibular ligament
       - Deltoid ligament
     + Muscles
       - Quadriceps
       - Hamstrings
       - Peroneals
       - Tibialis Anterior
       - Tibialis Posterior
       - Gastrocnemius
       - Soleus
       - Achilles Tendon
  2. Recognize common injuries to the lower extremity to include:
     + - Cruciate/Collateral Ligament Sprains
       - Meniscal injury
       - Patello-femoral injuries
       - Ankle sprains
       - Plantar Fasciitis
       - Turf toe
       - Thigh contusions
       - Quadriceps/Hamstring strains
       - Medial Tibial Stress Syndrome
     + Identify the mechanism of injury
     + Identify the signs and symptoms of the injury
     + Indicate appropriate treatment for the injury
     + Describe injury prevention strategies
       - Shin Guards
       - Shoes
       - Other sport specific protection devices
  3. Demonstrate theory and principles of prophylactic taping.
     + Analyze the basic principles of prophylactic taping.
     + Identify the necessary supplies and their purpose for prophylactic taping.
       - Athletic tape (various sizes)
       - Underwrap
       - Heel and lace pad
       - Adhesive spray
       - Shark/Scissors
     + Analyze the basic principles of proper tape removal.
     + Explain the terminology associated with prophylactic taping procedures.
       - Anchor
       - Stirrup
       - Horseshoe
       - Spica
       - Heel-lock
       - Checkrein/fan
     + **REQUIRED SKILL**-Competently tape an ankle using the standard prophylactic taping method.
     + **OPTIONAL SKILL**-Competently tape an arch using the standard prophylactic taping method.
  4. Identify principles of protective bracing.
     + Discuss the differences between functional and prophylactic bracing.
     + Identify the function of joint sleeves (compression).
  5. Vocabulary:
     + Atrophy
     + Bursa
     + Cartilage
     + Crepitus
     + Ligament
     + Tendon
     + Valgus
     + Varus

Anatomical Positions and Directions

* + - Superior
    - Inferior
    - Anterior
    - Posterior
    - Medial
    - Lateral
    - Distal
    - Proximal
    - Superficial
    - Deep
    - Ventral
    - Dorsal
    - Prone
    - Supine
    - Bilateral
    - Contralateral
    - Unilateral

Movements of the Foot and Ankle

* + - Inversion
    - Eversion
    - Dorsiflexion
    - Plantarflexion

Students will explore specific sports injuries of the lower extremities and apply athletic injury prevention principles.

1. review the anatomy of the lower extremity.
   1. **Bones**
      1. **Femur**
      2. **Patella**
      3. **Tibia**
         1. Tibial Tuberosity
         2. Medial malleolus
      4. **Fibula** -Lateral malleolus
      5. **Tarsals**
         1. Calcaneus
         2. Talus
      6. **Metatarsals**
      7. **Phalanges**
   2. **Joints**
      1. **Tibialfemoral** - Allows knee flexion/extension
      2. **Patellofemoral**
      3. **Tibiotalar** (ankle joint; can also be called talocrural) - Allows ankle plantar/dorsiflexion
      4. **Subtalar** (joint between talus and calcaneus) - Allows inversion/eversion
      5. **Midfoot** (joints where tarsals meet metatarsals)
      6. **Metatarsal Phalengeal (MP)-** Allows toe flexion/extension
      7. **Interphalengeal (PIP & DIP)** - Allows flexion/extension of toe segments
   3. **Soft Tissues**
      1. **Patellar Tendon** - Attaches the quadriceps muscle group to the tibia
      2. **Menisci of the knee** – cartilage rings that deepens the joint. Outer 1/3 has a blood supply, rest is avascular.
         1. Lateral Meniscus
         2. Medial Meniscus -Has a deep attachment to the MCL.
      3. **Knee Ligaments**
         1. Medial Collateral (MCL) – resists valgus forces
         2. Lateral Collateral (LCL) – resists varus forces
         3. Anterior Cruciate (ACL)- resists anterior displacement of the tibia
         4. Posterior Cruciate (PCL) – resists posterior displacement of the tibia
      4. **Achilles Tendon** - Attaches the calf muscles to the calcaneus.
      5. **Ankle Ligaments**
         1. Anterior tibiofibular – resists forced dorsiflexion and rotation of the talus
         2. Anterior talofibular – resists plantar flexion and inversion forces
         3. Deltoid – resists eversion forces
   4. Muscles

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| --- | --- | --- |
| Muscle | Location | Function |
| **Quadriceps Femoris**   * **Rectus Femoris** * **Vastus Medialis** * **Vastus Lateralis** * **Vastus Intermedius** | Anterior Thigh | Extends the knee |
| **Hamstrings**   * **Semimembranosus** * **Semitendinosus** * **Biceps Femoris** | Posterior Thigh | Flexes the knee |
| **Tibialis Anterior** | Anterior lower leg | Dorsiflexion of ankle |
| **Gastrocnemius** | Posterior lower leg | Plantar flexion of ankle; assists in knee flexion |
| **Soleus** | Deep to the gastrocnemius | Plantar flexion of the ankle |
| **Tibialis Posterior** | Posteromedial lower leg | Inversion of the foot/ankle |
| **Peroneus Longus / Brevis** | Lateral lower leg | Eversion of the foot/ankle |

Common Injuries to the lower extremity:

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| --- | --- | --- | --- | --- |
| Common Injuries to the Upper Extremity | | | | |
| Injury | Mechanism of Injury | Signs and Symptoms | Treatment | Prevention Strategies |
| **Thigh Contusion** | Severe impact to the thigh musculature | Pain, loss of function, swelling, decreased ROM | Ice, compression with knee flexed. MUST be managed appropriately to avoid complications. | Protective equipment |
| **Muscle strains**  **(Quads/hamstrings)** | Sudden stretch or sudden contraction | Pain, spasm, loss of function, swelling, possible deformity. | RICE, flexibility and strengthening exercises. | Proper warm-up, stretching and strengthening. |
| **Medial Collateral ligament sprain (knee)** | Valgus force or tibial external rotation | Pain medial knee, mild swelling, joint stiffness, possible joint instability. | RICE, ROM and strengthening exercises, restrict activity until asymptomatic. | Lower extremity strengthening and conditioning. |
| **Lateral Collateral ligament sprain (knee)** | Varus force or tibial internal rotation. | Pain lateral knee, mild swelling, possible joint laxity. | RICE, ROM and strengthening exercises, restrict activity until asymptomatic. | Lower extremity strengthening and conditioning. |

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| **Anterior Cruciate ligament sprain** | *Noncontact:*  - deceleration  - foot planted  - rotation  - valgus stress  *Contact:*  hyperextension w/foot planted | Hears or feels a “pop”, rapid swelling, joint instability. | RICE, restore ROM and strength, surgery required to reconstruct the ligament. | Lower extremity strengthening and conditioning. |
| **Posterior Cruciate ligament sprain** | -Falling on bent knee  - direct force to front of knee  - rotational forces | Hears or feels a “pop”, minimal swelling, posterior tibial sag. | RICE, restore ROM and strength. Surgery is controversial. | Lower extremity strengthening and conditioning. |

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| **Meniscus tear** | Weight bearing with rotational force. | Swelling, joint line pain, loss of motion, locking or giving way. | RICE  *Avascular area:*  Surgically trimmed and smoothed.  *Vascular area:*  Surgically repaired. | Lower extremity strengthening and conditioning. |
| **Patellar subluxation or dislocation** | Combination of foot planted, deceleration, and change of direction. | Obvious deformity, pain, swelling, limited ROM. | RICE and immobilization initially, then ROM and strengthening exercises. McConnell taping or bracing. | Lower extremity strengthening and conditioning. |
| **Patellar tendinitis**  **“Jumper’s knee”** | Repetitive deceleration | Vague pain and tenderness of patellar tendon that worsens with running/jumping activities. | Rest, ice, NSAID medications, patellar strap, friction massage, and lower extremity strengthening. | Progressive increase in frequency/intensity of training. Lower extremity strengthening and conditioning. |

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| **Patellofemoral syndrome (abnormal tracking of patella in femoral groove)** | -tight hamstring and calf muscles  - increased Q-angle  -weak quadriceps muscles  -poor foot mechanics | Tenderness of one or more patellar edge, dull ache, crepitus, pain with compression, positive Apprehension test. | NSAIDs, quadriceps strengthening, sleeve with buttress and/or McConnell taping, orthotic foot insert. | Lower extremity strengthening and conditioning. |
| **Medial tibial stress syndrome**  **“shin splints”** | Repetitive running activities. | Diffuse pain in distal medial tibia, increasing with activity. | Correct faulty foot mechanics with footwear, or orthotic foot insert, calf stretching | Appropriate footwear for activity, lower leg flexibility and strengthening, orthotic foot inserts. |

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| **Ankle sprain** | ***Inversion:*** forced inversion and plantar flexion “rolling”  ***Eversion:*** forced eversion of ankle – high risk for fracture.  ***Syndesmosis*** *(high):* forced inversion with rotation of the talus. | Pain, swelling, decreased ROM, possible joint laxity. | RICE, symptomatic modalities, taping and/or bracing. | Appropriate footwear for activity, lower leg strengthening, proprioceptive training, taping and/or bracing of joint. |
| **Plantar fasciitis** | Tight calf muscles, poor arch support, possible leg length discrepancy, over striding while running. | Medial heel pain, particularly in the morning; pain with forced dorsiflexion of the toes. | Calf stretching, plantar fascial stretching, heel cup, orthotic foot inserts. | Calf flexibility, correction of faulty foot mechanics. |
| **“Turf toe”** | Hyperextension sprain of the great toe. MP joint. Can be related to either trauma or overuse. | Pain at MP joint of great toe, increasing with extension of the joint. | Steel toe insoles or taping, symptomatic modalities. | Appropriate footwear, correction of faulty foot mechanics. |

**Injury Prevention Strategies**

1. Shin guards –
   * 1. Hard-shelled device made of many differing synthetic materials, including: fiberglass or polyurethane with a foam rubber under lining.
     2. Commercially marketed equipment worn in front of the shins (Lower leg over the tibia bone) to protect against a large range of leg injuries.
     3. Commonly used in:
        1. Soccer
        2. Rugby
        3. Baseball (Batters & Catchers)
        4. Hockey
        5. Other sports where it is deemed necessary
2. Shoes –
   1. 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.
   2. Improperly fitted shoes can result in
      1. Mechanical disturbances that affect the body’s total postural balance.
      2. Problems with the joints and muscles.
      3. Chronic abnormal pressures to the foot can often cause permanent structural deformities.
      4. Potential dangerous calluses and blisters.
   3. Fitting sports footwear can be difficult
      1. It is important to measure both feet.
         1. A person’s left foot generally varies in size and shape from the right foot.
         2. Shoes should be selected for the longer of the two measurements
         3. The shoe should be long enough that all toes can be fully extended without being cramped.
      2. The athlete should simulate the conditions under which they will perform with the shoes on.
      3. 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.
   4. Each sport places unique stresses and performance demands on the foot
      * 1. Footwear can mean the difference between success, failure, or injury in competition.
        2. A shoe with cleats presents some additional problems in fitting.
           1. Cleats must be properly positioned under the two weight-bearing joints and must not be felt through the soles of the shoes.
   5. Additional Footwear –
3. All athletic socks should be clean, dry and without holes to avoid irritations.
   * + - 1. Poorly fitted socks can cause abnormal stresses on the foot.
     1. Orthotics may be helpful in treating a variety of foot problems, as well as other lower extremity problems involving the hip and knee.
        + 1. Commercial orthotics and insoles are intended for use by the general public and are not usually designed to withstand the rigors of sports activities.

Commercial orthotics, that are suited for sports, are generally not durable enough for long and hard extended use.

* + - * 1. Custom-made orthotics are fabricated from a variety of materials such as foam, felt, plaster, or aluminum.

Custom-made orthotics are customized to the individuals natural curvature of each foot.

1. Other sport specific protection devices –
2. In addition to the various types and functions of the protective equipment presented there are many specific devices designed to protect athletes. These may include:
   * + 1. 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.
       2. Limb Protection – 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.

**Standard 3: Demonstrate theory and principles of prophylactic taping.**

1. Analyze the basic principles of prophylactic taping.

Prophylactic taping is a preventive technique used for the protection, stabilization and care of athletic injuries.

1. General Guidelines
   1. Preparation
      1. The athletic trainer and athlete should be in a comfortable position.
         1. The athlete should be high enough so the athletic trainer doesn’t have to lean over.
         2. Try to make the athlete comfortable but maintain the extremity in the correct position while it is being taped.
      2. Place taped body part away from mechanism of injury
         1. Ankle – place in 90° dorsiflexion plus slight eversion.
      3. Be sure the area is dry, clean, and free of body hair.
         1. The area does not always have to be shaved when using underwrap (Pre-wrap).
         2. Underwrap helps to protect the skin but decreases the efficiency of the tape.
      4. Use some form of tape adherent (Spray) to ensure bonding of the tape to the skin.
         1. Cuts, blisters, and rashes should be covered with a clean non-stick pad prior to the use of adherent or tape.
         2. If underwrap is used, only one layer should be applied over the tape adherent.
      5. In areas with potential for friction blisters or burns, apply a lubricated pad.
         1. Heel-and-Lace pad with Skin Lube
   2. Taping
      1. Select width of tape according to body part.
      2. Begin with anchors on top and bottom to provide a base for other strips to attach to.
      3. Overlap each strip of tape to the previous strip of tape by half.
      4. Avoid spaces or gaps between tape segments
         1. These spaces may result in blistering or cutting of skin.
      5. Neatness over speed.
         1. Smooth and mold the tape to the natural contour of the area being taped.
         2. Never force the tape to go where you want it to go.
         3. Learn the contours of the different extremities.
         4. Use even pressure as you apply tape to avoid decreasing circulation
         5. Wrinkles can also cause cuts and blisters.
         6. If a fold or wrinkle appears, tear off that strip and readjust your angle.
      6. When taping over a muscle belly, allow for contraction.
         1. Don’t tape too tight!
         2. Use an elastic or stretch tape whenever possible.
      7. To tear tape
         1. Hold firmly on each side of the proposed tear line.
         2. Pull the free end away at an angle so that the force crosses the lines of the fabric at a sharp angle.
         3. When tape is properly torn, the edges should be straight with no loose threads.
   3. After Taping
      1. Check for comfort as well as signs of impaired circulation.
         1. Numbness
         2. Tingling
         3. Discoloration
         4. Loss of pulse
         5. Loss of function
   4. Precautions
      1. Never apply tape immediately after icing. Wait until the body part is warmed up.
      2. The effectiveness of taping for prevention and treatment of injury has been a matter of controversy for many years.
      3. Ankle taping to prevent injury should only be used in conjunction with proper exercise.
         1. Athletes with normal or near normal ankles should rely more on strengthening exercises than taping or bracing.
      4. 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.
      5. Reactions to tape adherent and skin irritations commonly develop with prolonged use of taping over a sport season.
         1. Usually these irritations are minor.
         2. Proper daily cleansing of the area that has been taped can sometimes prevent irritation
   5. Arguments against taping
      1. Include the following
         1. Tape usually becomes loose with wear.
         2. Because the skin is mobile, taping cannot be effective.
         3. Taping the ankle weakens the leg muscles.
         4. Moisture develops between the skin and tape, thus affecting the adherence of the tape.
         5. Tape tears under stress.
      2. Despite these arguments, most studies agree that taping does contribute to a lower incidence of injury and re-injury.
      3. Studies have also shown that prophylactic ankle taping is superior to lace-on braces for the first 20 minutes.
         1. After 20 minutes, taping is equal to bracing in its ability to support the ankle.
2. Identify the necessary supplies and their purpose for prophylactic taping.
3. Athletic tape (various size) –

Athletic tape is available in a variety of

* 1. Manufactures
  2. Widths (Sizes) 1”, 1.5”, 2”
  3. Colors
  4. Strength/Styles
     1. Static cloth-linen
     2. Elasticity or stretch
        1. Stretch or elastic tape is used for the smaller, more angular body parts such as the feet, hands, wrist and fingers.
  5. Tape should adhere readily when applied and should maintain this adherence despite profuse perspiration and activity.
  6. Tape should be stored and stacked in a cool place.

1. Underwrap or Pre-wrap is available in a variety of manufactures and colors. Underwrap helps to protect the skin but decreases the efficiency of the tape.
   1. It is to be used over areas that have not been shaved or are not free of body hair.
   2. It may also be used over areas of irritation due to adhesive tape.
   3. Only one layer should be applied.
   4. Improper application techniques can result in blisters or small skin lacerations.
2. Heel and lace pad –
3. Should be used in areas with potential for friction to prevent blisters and cuts.
4. Made from a friction-proofing material (foam) and a lubricant (skin lube).
5. Placed over the lacing area (Dorsal aspect) and to the back of the heel.

4. Adhesive spray –

Is a form of tape adherent to ensure bonding of the tape to the skin.

* 1. May be found in a wipe on form but more commonly used as an aerosol.
  2. There are various names and manufactures although most serve the same purpose.
     1. QDA (Quick Drying Adherent) - Cramer
     2. Tuf Skin - Cramer
     3. Pre-Tape - Mueller
     4. Stickum - Mueller
  3. Skin irritations and reactions to tape adherent may develop with prolonged use of taping over a sport season.

1. Shark / Scissors –
2. Special cutters are made for tape removal.
3. Avoid cutting over bony prominences.
4. Be careful to look for blisters or other skin irritation as the tape is removed
5. Analyze the basic principles of proper tape removal.
6. Tape should be removed immediately after use to decrease the chances of skin irritation.
7. Use either a Shark or special tape scissors.
8. Avoid cutting over bony prominences.
9. To use tape cutters
   1. Gently insert the blunt end under the tape
   2. Pull up as you side down the tape while cutting.
   3. Pull skin from the tape not vice versa.
   4. Be careful to look for blisters or other skin irritation as the tape is removed
10. Explain the terminology associated with prophylactic taping procedures.
11. Anchor –
    1. Provides a firm base to attach other tape ends.
    2. Anchors can be taped directly to skin so as to ensure better adherence.
    3. With an Ankle – adhere 1-2 anchor strips at about one third of the way up the lower leg & also at approximately the midpoint of the foot.
12. Stirrup –
    1. A vertical "U" piece of tape to support either side of the ankle.
    2. With an Ankle – adhere a strip of tape to the inside (Medial) upper (Proximal) anchor, flowing down (Distal) the inside ankle, under the foot & up & over the outer (Lateral) edge of the ankle.
13. Horseshoe –

This term may be used in reference to two types of treatment procedures.

* 1. Foam or Felt Horseshoe Pad
     1. Used around the malleolus after an injury to fill in hollows, compress swelling and pad-sensitive areas.
     2. Usually kept in place with an elastic bandage or compression sock.
  2. A particular application of athletic tape associated with prophylactic taping procedures
     1. Also referred to as a “C-Strip” or “Spur”
     2. With an Ankle – adhere a strip of tape from the inside (Medial) of the mid-foot anchor, back across the Achilles tendon, & finishing up on the outer (Lateral) anchor.
     3. The combination of alternating stirrup & horseshoe techniques is known as the basket-weave.
        1. 2-3 strips each, and with each change in position, the tape overlaps by half of the width.

1. Spica –
   1. A strip of tape or bandage applied in overlapping opposite spirals, in the shape of a figure eight, to immobilize a digit or limb.
   2. Used to bind extremities to their trunk or root.
   3. Namely used in the thumb, hip and shoulder

1. Heel-Lock –
   1. Tape makes a "U" pattern around the side to lock in one side of the heel.
   2. Lateral – A Lateral (outer) Heel Lock is applied to support the back of the ankle.
      1. Start at the mid frontal area of the ankle & flow to the outer edge of the foot, in a downwards direction, towards the back of the arch. Go under the foot & cup the heel as shown, moving in an upward direction across the Achilles tendon, over the outer edge of the side of the ankle & back on to where you started.
   3. Medial – A Medial (inner) heel lock is applied in the opposite direction of the Lateral Heel lock.
      1. Start at the mid frontal area of the ankle & flow to the inner edge of the foot, in a downwards direction, towards the back of the arch. Go under the foot & cup the heel as shown, moving in an upward direction across the Achilles tendon, over the inner edge of the side of the ankle & back on to where you started.
2. Checkrein / fan –
   1. A crossed fan or X-taping used to for immobilization of a joint and to protect against hyperextension.
   2. Used to protect the elbow, wrist and knee joints

**Standard 4: Identify principles of protective bracing.**

A. Discuss the differences between functional and prophylactic bracing.

1. The effectiveness of prophylactic (to prevent or avoid) braces is controversial.
   1. To date, studies are divided, with some indicating a decrease in knee injuries and others reporting no difference or an increase in injuries.
2. The braces are used by players who are at a greatest risk of being injured due to:
   1. Position or sport being played
   2. Previous injury
3. There are a number of different braces and manufactures on the market.
   1. Knee braces are designed to provide protection against lateral and medial, but not rotary forces.
4. 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.
5. Following serious joint injury that produces chronic instability or necessitates surgery, a functional, customized orthopedic brace may be prescribed for the athlete.
   1. These functional braces are designed to prevent re-injury in athletes with prior injury.
   2. The effectiveness of these braces has been better documented than that for prophylactic braces.
6. Identify the function of joint sleeves (compression).
7. 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.
8. Pads or guards may be added that protect the athlete from falls or a direct blow to a joint.
9. Joint sleeves may help to dissipate an anterior striking force but fails to protect the joint against lateral, medial, hyperextension or twisting forces.
10. Sleeves are generally composed of elastic or neoprene material.

**Standard 5: Vocabulary**

**Atrophy** – wasting away of organ or tissue; a decrease in muscle or tissue size, usually caused

by disease, injury, or loss of innervation.

**Avulsion** – tearing or pulling away of part of a structure.

**Bursa** – a fluid-filled sac at a joint that prevents friction.

**Cartilage** – gristle-like padding that lies on or between bones.

**Crepitus** – crackling sound or feeling.

**Tendon** – tissue that connects muscle to bone.