Station 1:

**The Musculoskeletal System and Injuries to the Lower Extremities**

Review the anatomy and physiology of the musculoskeletal system and injuries to the lower extremities, including patient assessment. The OEC technician will review and demonstrate care of injuries using a variety of splints, including ski or sport boot removal. (Chapters 7, 10, 17, and 20.)

**Skill Station:** Facilitate a group discussion of the mechanisms of injury, common musculoskeletal injuries, and the assessment of lower extremity injuries, including all objectives listed below. Demonstrate the use of a variety of splints. All OEC technicians will perform an assessment, including scene size-up and both a primary and secondary assessment.

**Special Note...**

**The OEC Instructor will demonstration, for his group of 4, a full patient assessment with focus on leg utilizing DCAP BTLS, and application of quick splint.**
The OEC technician will:

• Identify the role of a trauma center in improving the survival chances of a trauma patient. (Refer to your local protocol and the location of your trauma center.)
• Compare and contrast high-velocity injuries and low-velocity injuries.
• Identify, compare, and contrast the signs and symptoms of dislocations, sprains, and fractures of lower extremities.
• Demonstrate the care of patients with the following injuries, using a variety of splints:
  1. Knee (dislocation);
  2. Tib/fib (open fracture); and
  3. Foot or ankle injury when the patient indicates that pain is an eight on a scale of 1-to-10.
• OEC technician will demonstrate an adult patient assessment (trauma) for a lower extremity injury (see Skill Guide: “Trauma Assessment,” page 252), to include:
  1. Scene size-up;
  2. Primary assessment;
  3. Secondary assessment; and
  4. Reassessment.
• Identify the five mechanisms of injury.
• Demonstrate the removal of a ski or sport boot from an injured lower extremity.
**Scenario 1-1: Tib/fib closed fracture.** A mother is standing near the fence surrounding the children’s ski school watching her 3-year-old daughter take a lesson when she is struck by an out-of-control beginner skier who is unable to stop or avoid running into her. The mother is struck and pushed against the fence rail, where she strikes her right lower leg against a fence post. The mother has a closed fracture of the lower right leg. There is noticeable deformity, swelling, and pain upon palpitation. Distal CMS is intact.

**Scenario 1-2: Knee dislocation.** A skier in search of the last bit of untouched powder on the hill has fallen under the lift line and banged his left knee into a tree, dislocating it. The skier is complaining of severe pain in the knee and states that the foot feels numb (impaired circulation). You expose the injured knee and see localized swelling and a deformity with limited motion.
Scenario 1-3: Unstable ankle of a hiker. A 34-year-old hiker lost her balance stepping over a fallen tree, and her right foot stepped into a hole below the fallen tree that she did not see. When you arrive, the patient is sitting on the fallen tree. She reports that she heard a loud pop and is unable to put weight on her foot. Upon exposing the injured area, you discover swelling on the lateral side of the ankle.

Scenario 1-4: Severe bleeding with leg fracture at the boot top. A 20-year-old male skier merges into another trail at the same time as a 15-year-old boarder is coming down the trail. The boarder is moving faster than the skier and strikes the skier on his left leg just at the boot top with his board. When you arrive, the skier is sitting on the snow holding his hand over the bleeding area complaining of pain (seven out of 10 on a pain scale) at the 3-inch cut on the lower left leg. It appears that the bleeding has been controlled by direct pressure. The boarder is uninjured. You discover they are brothers spending time together.

The OEC technician must demonstrate removal of a ski or sport boot from the injured leg before splinting.
Compare and Contrast Sprain and Strain:

**Sprain:**
1. an injury involving the stretching or tearing of a ligament
2. occurs when a joint is displaced beyond its normal range of motion
3. completely-torn ligaments often need surgical repair

**Strain:**
1. a stretched or torn muscle or tendon, does not result in bone, ligament or joint damage
2. may be mild or may be severe requiring surgical repair and months of healing

**Difference Between a Ligament and a Tendon:**

**Ligament:** a tissue that connects one bone to another.

**Tendon:** a tissue that connects a muscle to a bone
**Foot and Toe Injuries:**

1. Rare in winter snow sports where harder boots protect the foot
2. More frequent in sports where soft shoes are worn
3. Toe injuries and fractures occur most commonly in kicking sports
4. Calcaneus (heel bone) fractures occur in jumping/landing sports
5. Metatarsal fractures also occur in jumping sports (basketball, volleyball, etc.)
6. The fifth metatarsal bone is the most likely to be fractured
7. Stress or fatigue fractures occur in foot-loading sports such as running

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**Figure 20-50** Metatarsal fractures are the most common traumatic foot injuries.
Knee Joint Trauma

**Figure 20-44** When assessing the knee, look for swelling, point of tenderness, and bruising.

Following trauma, the knee joint can fill up with blood, synovial fluid, or both. In all cases, a large, swollen knee joint usually means that something is seriously wrong with the knee. Rapid swelling of the knee joint usually indicates a buildup of blood and a more serious injury. A buildup of excessive synovial fluid in the knee takes longer, usually hours, resulting in gradual swelling.
Types of Fractures

<table>
<thead>
<tr>
<th>Fracture Type</th>
<th>Description</th>
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<tbody>
<tr>
<td>Butterfly fragment</td>
<td>A fracture that occurs upon direct trauma to a long bone, in which a third piece of broken bone that looks like a butterfly’s wing is on the side opposite the trauma; seen in fractures of the tibia and humerus.</td>
</tr>
<tr>
<td>Comminuted</td>
<td>A fracture that has three or more fragments; may be seen in any long bone.</td>
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<tr>
<td>Compression</td>
<td>A fracture in which a bone becomes shortened into itself; results when an axial load is put on the bone; occurs in the vertebrae.</td>
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<tr>
<td>Epiphyseal</td>
<td>A fracture of the bone’s growth plate, near the end of the bone; occurs in children who are still growing.</td>
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<tr>
<td>Greenstick</td>
<td>An incomplete fracture in which the bone “bends” like a stick from a young tree branch; most commonly occurs in children.</td>
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<tr>
<td>Impacted</td>
<td>A fracture in which one of the bone ends is embedded into each other.</td>
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<tr>
<td>Oblique</td>
<td>A fracture that runs through the bone at an angle.</td>
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<tr>
<td>Pathologic</td>
<td>A fracture in an area of diseased or damaged bone; seen in cancerous bone or in a bone that is weakened by age.</td>
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<tr>
<td>Spiral</td>
<td>A fracture in which a twisting force causes a spiral-shaped injury in a long bone, especially the tibia.</td>
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<tr>
<td>Transverse</td>
<td>A fracture that runs straight across the bone.</td>
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</tbody>
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Figure 20-47  A boot top fracture can involve the tibia, the fibula, or both bones.
Types of Fractures – 2

Figure 20-17 Types of fractures.

Figure 20-46 An open fracture of the tibia.

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# Sprains, Strains, Fractures, & Dislocations
## Signs & Symptoms

<table>
<thead>
<tr>
<th>Condition</th>
<th>Signs &amp; Symptoms</th>
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| Sprain: Stretched or Torn Ligament | Point tenderness over the injured ligaments  
Swelling and bruising within the zone of injury  
Joint instability characterized by abnormal motion of the affected joint  
Decreased motion due to pain, swelling, and/or ligament instability  
Difficulty bearing weight on injured joint (in lower extremities) |
| Strain: Stretched or Torn Muscle or Tendon | Point tenderness over a muscle or a portion of a muscle  
Pain when using the injured muscle to flex or extend an extremity  
Bruising over a muscle  
Swelling or hematoma over a muscle |
| Fracture: A Break in a Bone’s Cortex | Pain at fracture site that worsens upon movement of the affected bone  
Tenderness with palpation  
Swelling due to internal bleeding from the fracture site  
Ecchymosis  
Decreased motion due to pain, and lack of bone continuity  
Deformity due to bone misalignment  
Any wound over a suspected broken bone is always considered an open fracture sign  
Bone crepitus |
| Dislocation: Separation or Displacement of the bones of a joint | Pain  
Swelling  
Deformity  
Reduced joint motion  
Joint “locking” or “freezing” (a complete inability to move the joint) |
**Scenario 1-1 Tib/Fib closed fracture** – parent at ski school

Patient is lying on the snow holding their R lower leg in considerable discomfort but attempting to remain calm because they know their child is watching them and is scared.

Primary Assessment:
Airway & Breathing intact – pt. speaking clearly in complete sentences
Circulation – strong radial pulse – no active bleeding from tib/fib fracture
Neurologic – A on AVPU, isolated RLE injury no MOI for spine injury

Secondary assessment:
Physical exam reveals tender R mid shin fracture with deformity & crepitus, CMS intact

**Scenario 2-1 Knee dislocation** – fall hitting knee on tree

Patient is sitting on snow complaining loudly of L knee pain. Wearing helmet and appropriate clothing for conditions. L binding is still attached with obvious deformity of L knee visible on general assessment.

Primary Assessment:
Airway & Breathing intact – pt. complaining of L knee pain loudly
Circulation – strong radial pulse – no active bleeding
Neurologic – A on AVPU, possible MOI for spine injury

Secondary assessment:
Physical exam –
Pain and tenderness in L knee with severely decreased sensation and ROM, cap refill > 2 seconds
**Scenario 1-3 Unstable ankle of a hiker**

Patient sitting on fallen tree complaining of R foot / ankle pain.

Primary Assessment:
Airway & Breathing intact – pt. speaking in complete sentences with rapid deep breathing
Circulation – strong radial pulse – no active bleeding
Neurologic – A on AVPU, no MOI for spine injury

Secondary assessment:
Physical exam reveals tenderness and pain in R ankle / foot area with obvious swelling, CMS intact but with limited range of motion due to pain.

**Scenario 1-4 Open boot top tib / fib fracture with moderate bleeding**

Patient is lying on the snow laughing and crying while holding their Left leg. Some blood noted on the ski boot and the snow around the L leg

Primary Assessment:
Airway & Breathing intact – pt. laughing and talking loudly
Circulation – strong radial pulse – moderate active bleeding from boot top tib/fib fracture
Neurologic – A on AVPU, possible MOI for spine injury

Secondary assessment:
Physical exam reveals tender L shin boot top fracture with deformity & crepitus, CMS intact bleeding easily controlled with direct pressure
(1-1) VS:
P – 130 strong regular
RR – 20 anxious, gritting teeth in attempt to remain calm and not cry/ yell
BP – as taken
Skin – Pale warm and dry
Temp – normal
AVPU – A mentating well, concerned about scaring child

S – RLE pain
A – NKDA
M – Metoprolol for Hypertension
P - Hypertension
L – Patient’s actual INS& OUTs
E – patient describes standing at fence and being struck from behind. Denies LOC.

(2-1) VS:
P – 110 strong regular
RR – 24 anxious, complaining about snow conditions loudly
BP – as taken
Skin – PWD
Temp – normal
AVPU – A upset

S – L knee pain
A – penicillin
M – Ibuprofen for chronic knee pain
P - previous L knee injury – surgery 10months ago
L – Patient’s actual INS& OUTs
E – patient describes skiing the last stash of powder and zigging when they should have zagged hitting the tree with their knee. Denies LOC
(3-1) VS:
P – 120 strong regular
RR – 26 anxious
BP – as taken
Skin – Flushed Warm & Moist (warm day)
Temp – normal
AVPU – A obvious discomfort but calm

S – R ankle/foot pain
A – morphine (hives)
M – none
P - denies
L – Patient’s actual INS& OUTs
E – patient describes stepping over downed tree across trail and stepping in a hole. They felt pain in their ankle / foot and heard a loud pop.

(4-1) VS:
P – 130 strong regular
RR – 20 anxious, yelling loudly
BP – as taken
Skin – Flushed Warm& moist (exertion racing brother)
Temp – normal
AVPU – A anxious, concerned about their mother’s probable reaction.

S – LLE pain
A – NKDA
M – Adderall
P - ADHD
L – Patient’s actual INS& OUTs
E – patient describes racing brother down mountain & winning until the snowboarder caught them from behind and they both crashed. Denies LOC.