

MUSCULOSKELETAL TREATMENT MODALITIES

1. CASTS

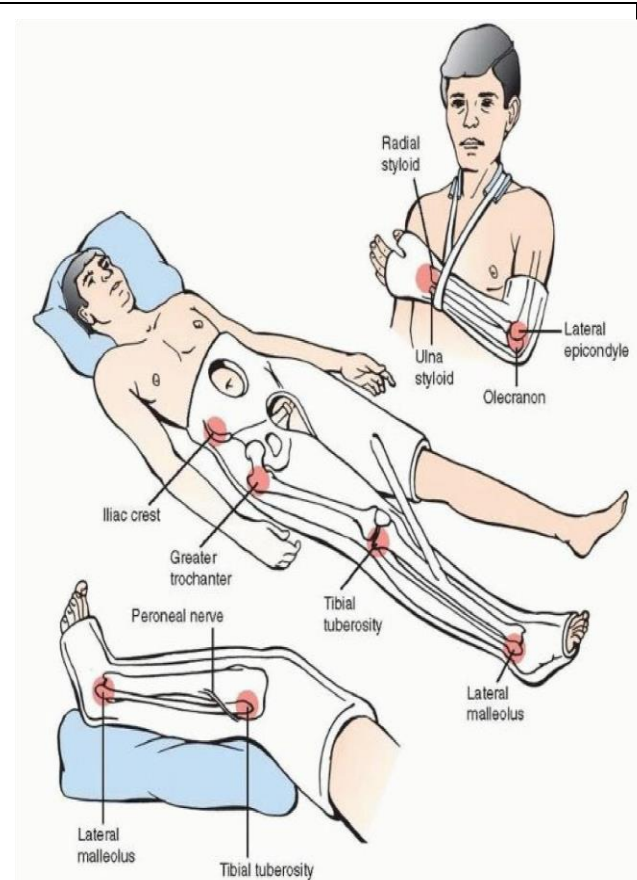
A cast is an immobilizing device made up of layers of plaster or fiberglass (water-activated polyurethane resin) bandages molded to the body part that it encases.

Purposes

🏠 To immobilize and hold bone fragments in reduction.	
🏠 To apply uniform compression of soft tissues.	🏠 To permit early mobilization.
🏠 To support and stabilize weak joints.	🏠 To correct and prevent deformities.

Types of Casts

- 1. Short-arm Cast:** Extends from below the elbow to the proximal palmar crease.
- 2. Gauntlet Cast (thumb spica):** Extends from below the elbow to the proximal palmar crease, including thumb.
- 3. Long-arm Cast:** from upper level of axillary fold to proximal palmar crease; elbow immobilized at **right angle**.
- 4. Short-leg Cast:** Extends from below knee to base of toes.
- 5. Long-leg Cast:** Extends from upper thigh to toes base; **foot is at right angle**.
- 6. Body Cast:** Encircles trunk & stabilizing spine.
- 7. Spica Cast:** Incorporates trunk and extremity.
 - 🌸 **Shoulder spica** → a body jacket that encloses trunk, shoulder, and elbow.
 - 🌸 **Hip-spica** → enclose trunk & lower extremity
- 8. Cylinder Cast:** used for upper or lower extremity, for fracture or dislocation of knee or elbow dislocation.



Complications of Casts

- 🏠 **Cast Pressure** → causes necrosis, pressure sores, and nerve palsies.
- 🏠 **Compartment syndrome** → result from increased progressive pressure within a confined space, thus **compromising circulation & function of tissues** within that space.

A tight cast, trauma, fracture, prolonged compression of an extremity, bleeding, and edema put patients at risk for compartment syndrome.

🏠 **Immobility & cast confinement** (body cast) can result in ***multisystem problems***.

🔔 **Nausea, vomiting, and abdominal distention** associated with cast syndrome (superior mesenteric artery syndrome, resulting in diminished blood flow to the bowel), adynamic ileus, and possible intestinal obstruction.

🔔 **Acute anxiety reaction symptoms** (ie, behavioral changes and autonomic responses → ↑RR, ↑PR, ↑BP, diaphoresis) associated with confinement in a space.

🔔 **Thrombophlebitis** and possible pulmonary emboli associated with immobility and ineffective circulation (eg, venous stasis).

🔔 **Respiratory atelectasis** and **pneumonia** associated with ineffective respiratory effort.

🔔 **Urinary tract infection** → renal and bladder calculi associated with urinary stasis, low fluid intake, and calcium excretion associated with immobility.

🔔 **Anorexia and constipation** → associated with decreased activity.

🔔 **Psychological reaction** (depression) → with immobility, dependence & loss of control.

Nursing Assessment

1) Assess neurovascular status of the extremity with a cast for signs of compromise.

a. Pain (pain out of proportion to injury is an indication for compartment syndrome).	
b. Tingling or numbness (paresthesia).	c. Discoloration—pale or blue.
d. Cool skin distal to injury.	e. Swelling.
f. Pain on passive extension (muscle stretch).	g. Paralysis.
h. Slow capillary refill; diminished or absent pulse.	

2) Assess skin integrity of casted extremity. Be alert for:

a. Severe initial pain over bony prominences → pressure ulcer.	
b. Odor.	c. Drainage on cast.

3) Carefully assess for positioning and potential pressure sites of the casted extremity.

- a. Lower extremity → heel, malleoli, dorsum of foot, fibula head, patella anterior surface.
- b. Upper extremity—medial epicondyle of humerus, ulnar styloid.
- c. Plaster jackets or body spica casts—sacrum, anterior and superior iliac spines, vertebral borders of scapulae.

4) Assess cardiovascular, respiratory, & GI systems for possible complications of immobility.

5) Assess psychological reaction to illness, cast, and immobility.

NURSING ALERT

Do not ignore the complaint of pain of patient in a cast. Suspect compartment syndrome or a pressure ulcer. Notify if symptoms persist. Cast may have to be split or removed.

Nursing Diagnoses

- ☆ Ineffective Tissue Perfusion (extremity) related to swelling & constrictive bandage or cast
- ☆ Impaired Physical Mobility related to condition and casting
- ☆ Risk for Injury related to potential complications

Nursing Interventions

Maintaining Adequate Tissue Perfusion

- ✿ Elevate extremity on cloth-covered pillow above the heart level. Keep heel off mattress.
- ✿ Avoid resting cast on hard surfaces or sharp edges that can cause denting or flattening of the cast and consequent pressure sores.
- ✿ Handle moist cast with palms of hands.
- ✿ Turn patient every 2 hours while cast dries.
- ✿ Assess neurovascular status hourly during the first 24 hours, then less frequently as condition warrants and swelling resolves.
- ✿ If symptoms of neurovascular compromise occur:
 - ⊗ Notify health care provider immediately.
 - ⊗ Bivalve the cast—split cast on each side over its full length into two halves.
 - ⊗ Cut underlying pad: blood-soaked padding may shrink & cause circulation constriction.
 - ⊗ Spread cast sufficiently to relieve constriction.
- ✿ If symptoms of pressure area occur, cast may be “**windowed**” (hole cut in it) so the skin at the pain point can be examined and treated. The window must be replaced so the tissue does not swell and cause additional pressure problems at window edge.

Minimizing the Effects of Immobility

- ✿ Encourage the patient to move about as normally as possible.
- ✿ Encourage compliance with prescribed exercises to avoid muscle atrophy & strength loss.
 - ⊗ Active ROM for every joint that is not immobilized at regular and frequent intervals.
 - ⊗ Isometric exercises for the muscles of the casted extremity. Instruct patient to alternately contract and relax muscles without moving affected part.
- ✿ Reposition and turn patient frequently.
- ✿ Avoid pressure behind knees → ↓ venous return & predisposes to thromboembolism.
- ✿ Use antiembolism stockings and sequential compression devices (SCD) as indicated.
- ✿ Administer prophylactic anticoagulants as prescribed.
- ✿ Encourage deep-breathing exercises and coughing ⇒ to prevent atelectasis & pneumonia.
- ✿ Observe for symptoms of cast syndrome—nausea, vomiting, abdominal distention, abdominal pain, and decreased bowel sounds.
- ✿ Encourage drink liberal fluid quantities → to avoid urinary infection & calculi formation.

NURSING ALERT

- 🔔 People at high risk for pulmonary emboli include older adults and persons with previous thromboembolism, obesity, heart failure, or multiple trauma.
- 🔔 Cast syndrome (superior mesenteric artery syndrome) is a rare sequela of body cast application, yet it is a potentially fatal complication. It is important to teach patients about this syndrome because this can develop as late as several weeks after cast application.

Preventing Complications

- ✿ Encourage balanced nutritional intake.
 - ⊗ Assess the patient's food preferences. Serve small meals.
 - ⊗ Provide natural bowel stimulants (eg, fiber).
 - ⊗ Monitor bowels, and use a bowel program if necessary.
- ✿ If symptoms of cast syndrome develop, report immediately to the health care provider.
 - ⊗ Place patient in a prone position, if tolerated, to relieve pressure symptoms.
 - ⊗ Use nasogastric suction as prescribed.
 - ⊗ Maintain electrolyte balance by I.V. replacement of fluids as prescribed.
 - ⊗ Prepare patient for cast removal or surgical relief of duodenal obstruction if necessary
- ✿ Facilitate patient participation in care planning and activities. Encourage verbalization of feelings and concerns regarding casting.
- ✿ Provide and encourage diversional activities.
- ✿ Instruct patient not to place objects into their casts. Advise patient of alternative methods of managing itching such as blowing cool air under the cast.

Hygienic Care

- Provide hygienic care of the patient.
- Protect cast from soiling.
 - Cover perineum with a towel and apply spray (lacquertype) to perineal area of cast. Tuck 4-inch (10-cm) strips of thin polyethylene sheeting under perineal area of cast and tape to cast exterior. Replace when soiling occurs.
 - Clean outside of soiled cast with a mild powdered cleanser and a slightly dampened or dry, clean cloth and pat dry completely, only when necessary.
- Roll the patient onto fracture bedpan; use small pillow in lumbosacral area for support.

Skin Care

- Inspect skin for signs of irritation:
 - Around cast edge.
 - Under cast—pull skin taut & inspect under cast, using a flashlight for illumination.
- Reach up under cast, and massage accessible skin.
- Protect the toes from the pressure of the bedding.

Patient Education and Health Maintenance

Neurovascular Status

- Instruct patient to check neurovascular status and to control swelling.
 - Watch for signs and symptoms of circulatory disturbance, including blueness or paleness of fingernails or toenails accompanied by pain and tightness, numbness, cold or tingling sensation.
 - Elevate affected extremity, and wiggle fingers or toes.
 - Apply ice bags as prescribed (one-third to one-half full) to each side of the cast, making sure they do not make indentations in plaster.
 - Call health care provider promptly if excessive swelling, paresthesia, persistent pain, pain on passive stretch, or paralysis occurs.
- Instruct patient to alternate ambulation with periods of elevation to the cast when seated. Encourage the patient to lie down several times daily with cast elevated.

Skin Irritation

Advise patient to prevent skin irritation at cast edge by padding edges of cast with moleskin or “petaling” cast edges with strips of adhesive tape.

Exercise

- Instruct patient to actively exercise every joint that is not immobilized and to perform isometric exercises (contract muscles without moving joint) of those immobilized to maintain muscle strength and to prevent atrophy.
- Tell patient to perform hourly when awake:
 - Leg cast—Push down on the popliteal space, hold it, relax, repeat. Move toes back and forth; bend toes down, then pull them back.
 - Arm cast—Make a fist, hold it, relax, repeat. Move shoulders.
- Encourage ambulation with weight-bearing restrictions.

Cast Care

- Advise to avoid getting cast wet, ⇒ causes skin breakdown as plaster cast becomes soft.
- Warn against covering a leg cast with plastic or rubber boots because this causes condensation and wetting of the cast.
- Instruct to avoid weight bearing or stress on plaster cast for 24 hours.
- Instruct to report if the cast cracks or breaks; instruct the patient not to try to fix it.
- Teach how to clean the cast:
 - Remove surface soil with slightly damp cloth.
 - Rub soiled areas with household scouring powder.
 - Wipe off residual moisture.

Teaching Safety Measures

To prevent falls, avoid walking on wet floors or sidewalks. To prevent pressure and injury to the skin, do not place objects inside the cast.

After Cast Removal

- ☎ Instruct to clean skin with mild soap & water, blot dry & apply emollient lotion to dry skin.
- ☎ Warn against scratching the skin.
- ☎ Advise to continue prescribed exercises. Gradually resume activities, & elevate extremity.

Evaluation: Expected Outcomes

- ☎ No pain, discoloration, or sensory or motor impairment of affected extremity; warm, with good capillary refill
- ☎ Ambulates with assistance; performing active ROM & isometric exercises every 1-2 hours
- ☎ No signs of complications

TRACTION

Traction is a pulling force applied to a part of a body or an extremity while a counter traction pulls in the opposite direction.

Purposes of Traction

1. To reduce and immobilize fracture.	2. To prevent deformity.
3. To lessen or eliminate muscle spasm.	4. To reduce pain.
5. To give the patient freedom for "in-bed" activities.	
6. To regain normal length and alignment of an injured extremity.	

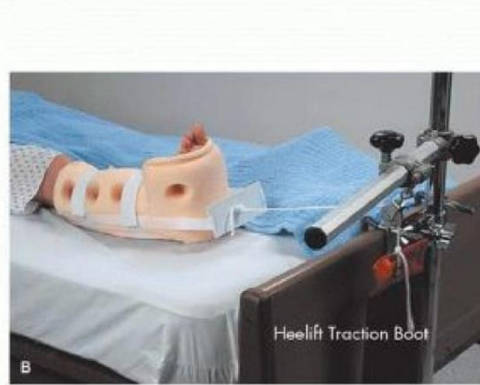
Types of Traction

a. Running Traction

- A form of traction in which the pull is exerted in one plane.
- May use either skin or skeletal traction.
- Buck's extension traction is an example of running skin traction.

b. Balanced Suspension Traction

- Uses additional weights to counterbalance the traction force and floats the extremity in the traction apparatus.
- The line of pull on extremity remains fairly constant despite changes in patient's position.



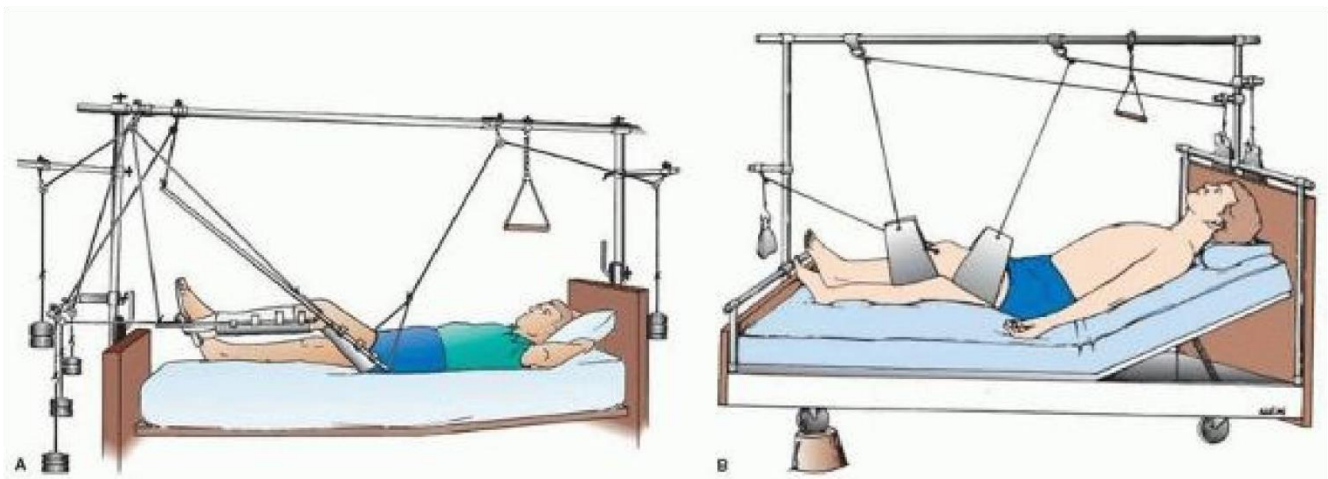
Application of Traction

Traction may be applied to the skin or to the skeletal system.

1. Skin Traction

- ✿ Accomplished by applying a light force that pulls on tape, sponge rubber, or special device (boot, cervical halter, pelvic belt) that is in contact with the skin.
- ✿ The pulling force is transmitted to the musculoskeletal structures.
- ✿ Skin traction is used as a temporary measure in adults to control muscle spasm and pain.
- ✿ It is used before surgery in the treatment of hip fracture (Buck's extension) and femoral shaft fractures (Russell's traction).
- ✿ It may be used definitively to treat fractures in children.

2. Skeletal Traction



Balanced skeletal traction using (A) Thomas leg splint and Pearson attachment, and (B) slings for support and suspension.

- ✿ Traction applied by the orthopedic surgeon under aseptic conditions using wires, pins, or tongs placed through bones and provides a strong, steady, continuous pull.
- ✿ Skeletal traction is used most frequently in treating fractures of the femur, humerus (supracondylar fractures), tibia, and cervical spine.

Complications

- Infection of pin tracts in skeletal traction.
- Skin breakdown and dermatitis under skin traction.
- Neurovascular compromise resulting in increased pain, muscle spasms, numbness, tingling, and loss of sensation.
- Inadequate fracture alignment resulting in posttreatment arthritis.
- **Complications of immobility include:**

○ Stasis pneumonia	○ Thrombophlebitis	○ Constipation.
○ Pressure ulcers	○ Urinary infection & calculi	

Nursing Assessment

- Assess pain, deformity, swelling, motor & sensory function, and circulation of extremity.
- Assess skin condition of the affected extremity, under skin traction and around skeletal traction, as well as over body prominences throughout the body.
- Assess for alignment of affected body part.
- Assess for signs and symptoms of complications.
- Assess traction equipment for safety and effectiveness.
 - The patient is placed on a firm mattress.
 - The ropes and the pulleys should be in alignment.
 - The pull should be in line with the long axis of the bone.
 - Any factor that might reduce the pull or alter its direction must be eliminated.
 - Weights should hang freely.
 - Ropes should be unobstructed and not in contact with the bed or equipment.
 - Help the patient to pull himself up in bed at frequent intervals.
 - The amount of weight applied in skin traction must not exceed the tolerance of the skin. The condition of the skin must be inspected frequently.
 - Cover exposed sharp ends of skeletal pins with cork or other pin covering to protect patient and caregivers from injury.
- Assess emotional reaction to condition and traction.
- Assess understanding of the treatment plan.

NURSING ALERT

Traction is not accomplished if the knot in the rope or the footplate is touching the pulley or the foot of the bed or if the weights are resting on the floor. Never remove the weights when repositioning the patient who is in skeletal traction because this will interrupt the line of pull and cause the patient considerable pain.

Nursing Diagnoses

- Impaired Physical Mobility related to traction therapy and underlying pathology
- Risk for Impaired Skin Integrity related to pressure on soft tissues
- Risk for Infection related to bacterial invasion at skeletal traction site
- Ineffective Tissue Perfusion: Peripheral related to injury or traction therapy

Nursing Interventions

1. Minimizing the Effects of Immobility

- Encourage active exercise of uninvolved muscles and joints to maintain strength and function. Dorsiflex feet hourly to avoid development of footdrop and aid in venous return.
- Encourage deep breathing hourly to facilitate expansion of lungs and movement of respiratory secretions.
- Auscultate lung fields twice per day.
- Encourage fluid intake of 2,000 to 2,500 mL daily.
- Provide balanced high-fiber diet rich in protein; avoid excessive calcium intake.
- Establish bowel routine through use of diet and stool softeners, laxatives, and enemas, as prescribed.
- Prevent pressure on the calf & evaluate twice daily for the thrombophlebitis development.
- Check traction apparatus at repeated intervals—the traction must be continuous to be effective, unless prescribed as intermittent, as with pelvic traction.
 - With running traction, patient may not be turned without disrupting the pull line.
 - With balanced suspension traction, the patient may be elevated, turned slightly, and moved as desired.
- Use SCDs and compression stockings as indicated.
- Administer prophylactic anticoagulants as prescribed.

NURSING ALERT

Every complaint of the patient in traction should be investigated immediately to prevent injury.

2. Maintaining Skin Integrity

- Examine bony prominences frequently for evidence of pressure or friction irritation.
- Observe for skin irritation around the traction bandage.
- Observe for pressure at traction-skin contact points.
- Report complaint of burning sensation under traction.
- Relieve pressure without disrupting traction effectiveness.
 - Make sure that linens and clothing are wrinkle-free.
 - Use lambs' wool pads, heel & elbow protectors, and special mattresses as needed.

- Special care must be given to the back every 2 hours because the patient maintains a supine position.
 - Have patient use trapeze to pull self up and relieve back pressure.
 - Provide backrubs.

3. Avoiding Infection at Pin Site

- Monitor vital signs for fever or tachycardia.
- Watch for signs of infection, especially around the pin tract.
 - The pin should be immobile in the bone, and the skin surrounding the wound should be dry. Small amount of serous oozing from pin site may occur.
 - If infection is suspected, percuss gently over the tibia; this may elicit pain if infection is developing.
 - Assess for other signs of infection: heat, redness, fever.
- If directed, clean the pin tract with sterile applicators and prescribed solution or ointment (ie, normal saline, sterile water, chlorhexidine)—to clear drainage at the entrance of tract and around the pin, because plugging at this site can predispose to bacterial invasion of the tract and bone.

4. Promoting Tissue Perfusion

- Assess motor and sensory function of specific nerves that might be compromised.
 - Peroneal nerve—have patient point great toe toward nose; check sensation on dorsum of foot; presence of footdrop.
 - Radial nerve—have patient extend thumb; check sensation in web between thumb and index finger.
 - Median nerve—thumb-middle finger apposition; check sensation of index finger.
- Determine adequacy of circulation (eg, color, temperature, motion, capillary refill of peripheral fingers or toes).
 - With Buck's traction, inspect the foot for circulatory difficulties within a few minutes and then periodically after the elastic bandage has been applied.
- Report promptly if change in neurovascular status is identified.

5. Patient Education and Health Maintenance

- Teach the patient the purpose of traction therapy.
- Delineate limitations of activity necessary to maintain effective traction.
- Teach use of patient aids (eg, trapeze).
- Instruct the patient not to adjust or modify traction apparatus.
- Instruct the patient in activities designed to minimize effects of immobility on body systems.

- Teach the patient necessity for reporting changes in sensations, pain, movement.

Evaluation: Expected Outcomes

- Exercises as instructed; deep breaths hourly; fluid intake 2,000 to 2,500 mL/24 hours
- No signs of skin breakdown under traction bandage or over bony prominences
- No drainage, redness, or odor at pin site
- No motor or sensory impairment; good capillary refill, color, and warmth of extremity

EXTERNAL FIXATION

External fixation is a technique of fracture immobilization in which a series of transfixing pins is inserted through bone and attached to a rigid external metal frame. The method is used mainly in the management of open fractures with severe soft-tissue damage.

EXTERNAL FIXATION. An alternative treatment for some fractures is external fixation. This treatment is used when bone damage is severe, as in crushed or splintered fractures, or if the bone has numerous fractures. After the fracture is reduced, the physician surgically inserts pins into the bone. The pins are held in place by an external metal frame to prevent bone movement. External fixation is ideal for the patient who has an open fracture with soft tissue damage that needs to be treated at the same time. Like the patient in skeletal traction, the patient with this device is at risk for complications of skeletal pins, which include pin reaction, compromised circulation, and infection. Pin sites are observed often for evidence of infection. Pin site care varies from facility to facility. The overriding principle is to ensure that strict aseptic technique is always maintained because the pin is a pathway for microorganisms to directly enter bone tissue and cause osteomyelitis (see the *Nursing Care Plan for the Patient with External Fixation of the Lower Extremity*).

Nursing Interventions for a Patient with a Cast

1. Assess color, warmth, circulation, and movement (CWCM) every 1 to 2 hours for 24 hours and then qid and prn.

- Assess cast for tightness (ask patient) and for rough or frayed edges (can interfere with skin integrity).
- Make sure patient can move (wiggle) all digits distal to the cast.

2. With newly applied casts (wet):

- Never grasp a wet cast to hold or move it, and do not place it on any surface that can cause an indentation.
Use only the palms of the hands, because finger pressure on a wet cast can cause pressure points on the inside surface.
- Make sure patient is turned every 1 to 2 hours to prevent flattening of cast surface during drying.
- With hip spicas or any cast with an abductor bar, do not use bar to move limb or to help with turns.

- d. Inform patient that plaster casts give off heat when drying. Make sure cast air dries (may require 24 to 72 hours for complete drying).

Do not cover cast or use drying aids such as blow dryers. Place cast on absorbent surfaces, not plasticized pillows.

- e. Protect skin integrity by ensuring rough edges of cast are properly covered.
- f. Make sure patient knows to keep cast dry during bathing by covering with plastic and preventing water from seeping into cast ends.
- g. Synthetic casts (e.g., fiberglass) can be exposed to water (e.g., for hydrotherapy) as needed but require complete drying afterward.

3. Maintain tissue integrity within the cast.

- a. When assessing CWCM, assess visible skin for signs of impaired integrity.
- b. Cast edges can be smoothed and covered with stockinettes or gauze and tape (make sure there are no tape allergies) to prevent rubbing of skin.
- c. Monitor for signs and symptoms of infection, such as foul odor, heat, redness, and pain.
- d. Do not use skin products on affected limb.
- e. Monitor visible blood on the surface of the cast.

Outline area with a pen to observe for increasing size. Shadowing of blood not quite reaching the surface of the cast is fairly common but also should be circled and monitored.

- f. Never place any object inside the cast, and instruct patient not to do so. Explain the risk of skin damage.

Advantages

- Permits rigid support of severely comminuted open fractures, infected nonunions, and infected unstable joints.
- Facilitates wound care (frequent debridements, irrigations, dressing changes) and soft tissue reconstruction (delayed wound closure, muscle flaps, skin grafts).
- Allows early function of muscles and joints.
- Allows early patient comfort.