## Cast & Traction

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Abduction</td>
<td>Movement away from the center or median line of the body</td>
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<tr>
<td>Adduction</td>
<td>Movement toward the center or median line of the body</td>
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<tr>
<td>Avascular necrosis</td>
<td>Death of tissue due to insufficient blood supply</td>
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<tr>
<td>Brace</td>
<td>Externally applied device to support the body or a body part, control movement, and prevent injury</td>
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<td>Cast</td>
<td>Rigid external immobilizing device molded to contours of body part</td>
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<td>Cast syndrome</td>
<td>Psychological (claustrophobic reaction) or physiologic (superior mesenteric artery syndrome) responses to confinement in body cast</td>
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<tr>
<td>Continuous passive motion (CPM) device</td>
<td>A device that promotes range of motion, circulation, and healing</td>
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<td>Edema</td>
<td>Soft tissue swelling due to fluid accumulation</td>
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<td>External fixator</td>
<td>External metal frame attached to bone fragments to stabilize them</td>
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<tr>
<td>Fracture</td>
<td>A break in the continuity of the bone</td>
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<td>Heterotopic ossification</td>
<td>Misplaced formation of bone</td>
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<tr>
<td>Neurovascular status</td>
<td>Neurologic (motor and sensory components) and circulatory functioning of a body part</td>
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<tr>
<td>Open reduction with internal fixation (ORIF)</td>
<td>Open surgical procedure to repair and stabilize a fracture</td>
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<tr>
<td>Osteomyelitis</td>
<td>Infection of the bone</td>
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<tr>
<td>Osteotomy</td>
<td>Surgical cutting of bone</td>
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<tr>
<td>Sling</td>
<td>Bandage used to support arm</td>
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<tr>
<td>Splint</td>
<td>Device designed specifically to support and immobilize a body part in a desired position</td>
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<tr>
<td>Traction</td>
<td>Application of a pulling force to a part of the body</td>
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<tr>
<td>Trapeze</td>
<td>Overhead assistive device to promote patient mobility in bed.</td>
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### Principles of Traction

1. Knowledge of the nature of the patient's condition and the purpose of his/her traction is essential to proper nursing care.
2. The back-lying position is necessary for effective tractioning.
3. The patient, ropes, and pulleys should be in proper alignment with the weights hanging free.
4. The patient in traction should be placed on a firm mattress.

### Principles of Cast Care

1. Careful and frequent observation should be made of the circulation, sensation, movement, temperature and distal pulses in an extremity when a cast has been applied.
2. If increased venous return is desired, the part should be level with or slightly elevated above the heart.
3. Application of cold causes vasoconstriction and decreases edema of affected areas.
4. The immobility caused by the presence of a cast may cause feelings of helplessness, dependence, hostility and anger.
5. Isometric muscle contractions will help prevent atrophy and maintain muscle strength.

<table>
<thead>
<tr>
<th>Types of Casts</th>
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<tbody>
<tr>
<td>Short-arm cast</td>
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<tr>
<td>Long-arm cast</td>
</tr>
<tr>
<td>Short-leg cast</td>
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<tr>
<td>Long-leg cast</td>
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<tr>
<td>Walking cast</td>
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<tr>
<td>Body cast</td>
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<tr>
<td>Shoulder spica cast</td>
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<tr>
<td>Hip spica cast</td>
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**Fiberglass casts**
- composed of water-activated polyurethane materials
- have the versatility of plaster, but are lighter in weight, stronger and more durable
- they are also water resistant
- consist of open-weave, nonabsorbent fabric impregnated with cool water-activated hardeners that bond and reach full rigid strength in minutes.
- Heat is given off, so the patient must be warned the heat/warmth of the cast while it is setting. It can be uncomfortable
- a waterproof lining can be used to allow patient to shower, swim or engage in hydrotherapy
- it is essential to drain the waterproof casts thoroughly to prevent skin breakdown
- do not place drying cast on plastic coated mats or bedding
- prevent denting of the cast, as it can put unrelieved pressure on the tissue beneath the cast

**Plaster Casts**
- plaster is less costly
- achieves a better mold than fiberglass
- not as durable
• takes 24 to 72 hours to dry completely
• rolls of plaster of paris-impregnated bandages are wet in cool water and applied smoothly to the body.
• Heat is given off, so the patient must be warned of the heat/warmth. It can be uncomfortable
• a freshly applied cast should be exposed to circulating air to dry. It should not be covered with clothing or bed linens or placed on plastic-coated mats or bedding
• prevent denting of cast by using the palms of the hands
• a wet plaster cast appears dull & gray; sounds dull on percussion; feels damp; smells musty
• a dry plaster cast is white & shiny; resonant to percussion; feels firm; is odorless

Splints
• contoured splints of plaster or pliable thermoplastic materials may be used for conditions that do not require rigid immobilization and for injuries where swelling may be anticipated
• for short term use
• the splint needs to immobilize and support the body part in a functional position
• must be well padded to prevent pressure, skin abrasion and skin breakdown.
• Splint is over-wrapped with an elastic bandage applied in a spiral fashion with pressure uniformly distributed
• many splints are prefabricated

Braces
• for example orthoses
• used to provide support, control movement, and prevent additional injury
• many braces are prefabricated
• generally indicated for longer use than splints
• typically custom fitted to various parts of the body
• orthotist adjusts brace for fit, positioning, and motion so that movement is enhanced, deformities are corrected and discomfort is minimized

General Nursing Management of Patient in a Cast, Splint or Brace
• before cast, brace or splint is applied, the nurse must assess:
  ○ the patient's general health
  ○ present signs and symptoms
○ emotional status
○ understanding of the need for the device
○ condition of the body part to be immobilized

• the physical assessment of the body part must include the neurovascular status (CMSTP's! “color or cap refill”, motion, sensation, temperature, pulse and pain)
• physical assessment should also include degree & location of swelling, bruising and skin abrasions
• patient education of underlying pathologic conditions and education on the purpose and expectations of the prescribed treatment
• warn patient of the head and hardening reaction to cast drying
• CONTINUALLY monitor pain!
• Most pain can be managed by administering analgesic agents as prescribed, elevation of the extremity and application of cold packs

• A patient's unrelieved pain must be immediately reported to the physician!
• Pain associated with compartment syndrome is relentless and cannot be controlled by modalities such as elevation, application of cold and the usual dosages of analgesic
• Sever burning pain over bony prominences, especially the heels, anterior ankles and elbows, warns of impending pressure ulcers – Pain will decrease when ulceration occurs
• Sometimes it is necessary to modify the dressing, ace wrap, or even apply a new cast
• every joint that is not immobilized should be exercised & moved through ROM.
• While cast is on the nurse observes the pt for systemic signs of infection:
  ○ odors from the cast, brace or split
  ○ purulent drainage staining the cast
• Nurse needs to also monitor circulation, motion & sensation. Normal findings are:
  ○ minimal edema
  ○ minimal discomfort
  ○ pink color
  ○ warm to touch
  ○ rapid capillary refill
  ○ normal sensations
  ○ ability to exercise fingers or toes
• Frequently assess the “five P's” to recognize early diminished response and prevent lost of essential function.
  ▪ Pain
  ▪ Pallor
  ▪ Pulselessness
  ▪ Paresthesia
  ▪ Paralysis
Potential Complications

Compartment Syndrome

- occurs when there is increased tissue pressure within a limited space (e.g., cast, muscle compartment). The increased tissue pressure compromises the circulation and the function of the tissue within the confined area
- to relieve pressure the cast must be bivalved (cut in half longitudinally) while maintaining alignment
- if pressure is not relieved and circulation is not restored, a fasciotomy may be necessary to relieve the pressure within the muscle compartment

Pressure Ulcers

- pressure of a cast or inappropriately applied brace on soft tissues can cause tissue anoxia and pressure ulcers
- lower extremity sites most susceptible to pressure ulcers:
  - hell
  - malleoli
  - dorsum of the foot
  - head of the fibula
  - anterior surface of patella
- main pressure sites on upper extremity are
  - medial epicondyle of the humeros
  - ulnar styloid
- pt usually reports pain and tightness in the area of an ulceration warm area on cast or brace suggest underlying tissue erythema – skin breakdown can occur
- to inspect an area for a pressure ulcer, the brace may be removed
- to inspect an area for a pressure ulcer with a cast, the physician may need to bivalve or cut a window in the cast. Once the area is inspected & treated as needed the portion of the cast is replaced and help in place by an elastic compression. This will prevent window edema.
Disuse Syndrome

- Immobilization in a cast, brace or splint can cause muscle atrophy & loss of strength
- to prevent this, the pt needs to learn to tense or contract muscles without moving the part (eg, isometric muscle contraction)
- muscle-setting exercises (eg, quadriceps-setting and gluteal-setting exercises) are important in maintaining muscles essential for walking
- isometric exercises should be performed hourly while the pt is awake

Management of Immobilized Upper Extremity

- pt must readjust to many routine tasks
- the unaffected arm must assume all the upper extremity activities – suggest devices that are designed to aid one-handed activities
- pt may experience fatigue due to modified activities & the weight of the cast, brace or splint. Frequent rest periods may be necessary
- to control swelling, the immobilized arm should be elevated so that each joint is positioned higher than the preceding proximal joint (eg, elbow higher than the shoulder, hand higher than the elbow)
- Signs of circulatory disturbances in the hand:
  - cyanosis
  - swelling
  - inability to move fingers
  - Volkmann's contracture ([a specific type of compartment syndrome – Contracture of the fingers and wrist occurs as the result of obstructed arterial blood flow to the forearm and hand. The pt will be unable to extend the fingers, will describe abnormal sensation and will exhibit other signs of diminished circulation to the hand])

Management of Immobilized Lower Extremity

- application of a leg cast, brace or splint will impose a degree of immobility
- pt's leg must be support on pillows to heart level to control swelling
- ice packs should be applied as prescribed over the fracture site for 1 or 2 days
- the pt should be taught to elevate the immobilized leg when seated
- the pt should also assume a recumbent position several times a day with the immobilized leg elevated to promote venous return
- the nurse should assess circulation by observing the color, temperature and capillary refill of exposes toes
- nerve function is assessed by observing the pt's ability to move the toes and by asking about sensations in the foot
- numbness, tingling, and burning may be cause by peroneal nerve injury from pressure at the head of the fibula
- injury to the peroneal nerve as a result of pressure is a caused of footdrop. Consequently, the patient will drag the foot when ambulating.
Management of Pt with a Body or Spica Cast

- nursing responsibilities include preparing and positioning the pt, assisting with skin care & hygiene and monitoring for cast syndrome
- Pt education about the casting procedure should also be completed by the nurse
- medications for pain relief and relaxation administered before the procedure will enable the pt to cooperate during the application fo the cast
- the nurse turns the pt as a unit toward the uninjured side every 23 hours to relieve pressure and to allow the cast to dry
- important to avoid twisting the pt's body within the cast
- the nurse should turn the patient to a prone position, twice daily if tolerated, to provide postural drainage of the bronchial tree and to relieve pressure on the back
- inspect the skin around the edges of the cast frequently for sings of irritation
- the nurse can inspect some of the skin benath the cast by pulling the skin taut and using a flashlight
- reaching under the edges of the cash with the fingers will enable slight massage and bathing.
- The perineal opening must be large enough for hygienic care – to protect the cast from soiling, gore-tex liners are used prior to hip spica casting. If the cast is not gore-tex lined, the nurse can insert plastic sheeting under the dry cast prior to elimination
- the nurse must be aware of the psychological manifestations of cast syndrome – increased anxiety characterized by behavioral changes and automonic responses (increased heart rate, diaphoresis, dilated pupils, increased heart rate, elevated blood pressure). Providing a secure, safe environment helps prevent this type of cast syndrome.
- Physiologic cast syndrome responses are associated with immobility in a body cast – decreased physical activity leads to decreased gastrointestinal motility, and intestine gases accumulate. The intestinal pressure increases and ileus may occur. The pt exhibits abdominal distention, discomfort, nausea and vomiting.

Cast Removal

- nurse should prepare pt by explaining what to expectation
- cast will be cut with a cast cutter, which vibrates. The pt will feel the vibration and pressure during its use, but the cutter does not penetrate deeply enough to injure the patient's skin
- the cast padding is cut with scissors
- after removal of a brace or cast (and only sometimes with a splint) the formerly immobilized body part is weak from disuse, is still and may appear atrophied
- there may be extreme stiffness even after only a few weeks of immobilization
- the skin may be dry and scaly from accumulated dead skin and will be vulnerable to injury from scratching – wash the skin gently and lubricate with an emollient lotion
- exercises will be prescribed to help pt regain joint motion
- nurse and physical therapist will teach the pt to resume activities gradually
**Traction**

- Traction is the application of a pulling force to a part of the body. It is used to:
  - minimize muscle spasms
  - reduce, align and immobilize fractures
  - reduce deformity
  - increase space between opposing surfaces
- Traction must be applied in the correct direction and magnitude to obtain therapeutic effects

**Principles of Effective Traction**

- Whenever traction is applied, counter-traction must be used to achieve effective traction. Counter-traction is the force acting in the opposite direction. Usually, the pt's body weight and bed position supply the needed counter-traction.
- Traction must be continuous to be effective in reducing and immobilizing fractures.
- Skeletal traction is never interrupted.
- Weights are not removed unless intermittent traction is prescribed.
- Any factor that might reduce the effective pull or alter its resultant line of pull must be eliminated.
- The pt must be in good body alignment in the center of the bed when traction is applied.
- Ropes must be unobstructed.
- Weights must hang freely and not rest on the bed or floor.
- Knots in the rope or the footplate must not touch the pulley or the foot of the bed.

<table>
<thead>
<tr>
<th>Types of Traction</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Straight or Running traction</strong></td>
<td>Application of force in a straight line with the body part resting on the bed (Buck's extension traction is an example of straight traction)</td>
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<tr>
<td><strong>Balanced suspension traction</strong></td>
<td>Supports the affected extremity off the bed and allows for some pt movement without disruption of the line of pull</td>
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<tr>
<td><strong>Skin traction</strong></td>
<td>Traction applied to the skin</td>
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<tr>
<td><strong>Skeletal traction</strong></td>
<td>Traction applied directly to the bony skeleton</td>
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<tr>
<td><strong>Manual traction</strong></td>
<td>Traction applied with the hands. It is a temporary traction that may be used when applying a cast, giving skin care under a Buck's extension foam boot, or adjusting the traction apparatus.</td>
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