Splints: Applying to an Extremity

What is Involved in Applying a Splint to an Extremity?
› A splint is a device for support or immobilization of a limb or joint. The rigidity of the splint is determined by the material used. Preformed splints are now the most common type of splint used for patients with fracture, dislocation, or subluxation
› What: Splints are most commonly applied to immobilize the site of an injury to alleviate pain and allow the limb to heal in proper alignment. The splint can be applied as an emergency or temporary measure until the injury can be properly evaluated. Then, if fracture is diagnosed, the site of injury can continue to be splinted for the prescribed period of time. Additional uses for splints include postoperative immobilization and functional splinting (e.g., to facilitate walking in patients with neuromuscular disorders)
› How: Application of a splint is a noninvasive but sometimes painful procedure. An analgesic may be provided to reduce pain before splint application
› Where: Splinting of an extremity is performed in inpatient and outpatient healthcare settings and in the community
› Who: Splints are applied by nurses, physicians, midlevel practitioners (e.g., nurse practitioners, physician assistants), emergency medical responders, and appropriately trained lay persons. Splints are used by emergency medical responders to temporarily immobilize a limb before transporting the patient for further treatment, by allied health professionals (e.g., occupational and physical therapists) to immobilize a joint (e.g., the knee) to promote joint healing, by athletic trainers to immobilize an injured bone or joint before transporting an injured person, and by emergency room clinicians to stabilize fractures or sprains before patient assessment by an orthopedic clinician. Due to the need for expertise in clinical assessment and the ability to assist with prescribed treatment of patients with injuries that require splinting, this responsibility cannot be delegated to assistive healthcare staff in the clinical setting. Assistive staff may, however, assist by reporting patient concerns regarding the splint. It is usually appropriate for family members and other in-home caretakers to be present during the procedure. The presence of a supportive adult is important for children who require splint application because an adult’s presence will likely reduce the child’s anxiety and promote cooperation with the procedure

What is the Desired Outcome of Applying a Splint to an Extremity?
› The desired outcome of splint application to an extremity is to immobilize all or part of a limb by preventing movement of joints at or near the site of an injury

Why is Application of a Splint to an Extremity Important?
› Immobilization of one or more joints at or around an area of injury reduces risk for additional injury to wounded tissue

Facts and Figures
› A number of controlled clinical studies have compared the use of soft immobilizer splints with traditional casting methods in children with upper extremity fractures. Overall, existing studies suggest that soft immobilizer casts are as effective as plaster casts
in supporting the distal tibia and wrist in children during healing, and can be a more cost-effective option

› The proper application of a splint is a technical skill that requires training and practice; researchers recently reported that the use of a supplemental video teaching tool resulted in significant improvements in medical students’ ability to apply splints (Mehrpour et al., 2013)

› Researchers compared two different 10-week protocols that included the wearing of thumb splints, prescribed exercise, and connective tissue manipulation, in the treatment of 29 patients with trigger thumb (i.e., catching or locking of the thumb joint due to tenosynovitis). While it was found that both groups of patients experienced statistically significant improvements in joint inflammation and pain level following treatment, the more effective of the two protocols involved wearing a maximally restrictive splint (limited interphalangeal, metacarpophalangeal, and carpometacarpal joint motions) rather than a less restrictive splint during the night (Alsancak et al., 2015)

› Authors conducting a systematic review of literature on splinting versus casting for treatment of childhood wrist fractures—specifically, wrist-buckle fractures WBF, found that splinting is recommended over casting in regards to cost, function, and convenience. There was no evidence of increased pain or misalignment with the use of splinting versus casting (Hill et al., 2016)

› In a systematic review of nearly 1,500 patients with rheumatoid arthritis with wrist pain and poor grip, researchers found that splint use reduces wrist pain and improves grip (Ramsey et al., 2014)

What You Need to Know Before Applying a Splint to an Extremity

› Primary indications for splinting one or more joints of an extremity include the following:
  • To reduce swelling and allow the extremity to heal with minimal deformity (e.g., in cases of fracture or an injury that makes the extremity unstable [e.g., a joint dislocation])
  • To alleviate pain
  • To prevent further injury to soft tissues, blood vessels, or nerves in an injured extremity

› Precautions related to splinting include the following:
  • In a trauma setting, transportation of critically injured patients to a tertiary care facility should not be delayed by performing a lengthy evaluation of a noncritical extremity injury (e.g., fracture of the leg or arm)
  • When critical injuries require prompt treatment, prevention of further damage to an injured extremity can be rapidly accomplished by securing the patient to a spine board

› Splints are composed of many types of material (e.g., plaster of Paris, fiberglass, plastic, aluminum, preformed plaster). The splint material should be light-weight and rigid (i.e., resistant to changing shape) when the patient moves. The various types of splints and their indications are as follows:

<table>
<thead>
<tr>
<th>Splint type</th>
<th>Indications</th>
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<tr>
<td>Dorsal wrist</td>
<td>Sprains or soft tissue injuries of the wrist</td>
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<tr>
<td>Volar wrist</td>
<td>Sprains or soft tissue injuries of the wrist</td>
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<tr>
<td>Thumb spica</td>
<td>Immobilization of the thumb</td>
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<tr>
<td>Radial gutter</td>
<td>Immobilization of middle fingers</td>
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<tr>
<td>Ulnar gutter</td>
<td>Immobilization of third or fourth fingers</td>
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<tr>
<td>Sugar tong</td>
<td>Immobilization of wrist and elbow following fracture of the proximal forearm and of bones surrounding the elbow joint</td>
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<tr>
<td>Anteroposterior</td>
<td>Fracture of distal bones of the forearm</td>
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<tr>
<td>Posterior long-arm</td>
<td>Fracture of bones of the forearm and of bones surrounding the elbow joint</td>
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<tr>
<td>Posterior gutter (also called long-leg)</td>
<td>Fracture of the upper tibia, fibula, or bones surrounding the knee joint</td>
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<tr>
<td>Stirrup short-leg</td>
<td>Soft tissue injury or bone fracture of the ankle</td>
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In a trauma setting, emergency first responders may splint body parts together (e.g., arm to trunk, leg to leg, finger to finger) to immobilize an injured joint. Padding is typically applied to increase patient comfort. This approach is useful when traction devices and pre-made splints do not fit.

If a bone fracture is near a joint, that joint should be immobilized as well to prevent movement at the fractured area of the bone.

- To fully immobilize the affected joint, the splint should be long enough to extend beyond the joint, and should be approximately as wide as the area being splinted. To promote patient comfort and reduce pressure on tissues if the area swells, padding should be applied between the splint and the skin.

Splints are typically held in place with elastic bandage/wraps, Velcro straps, or tape.

Preliminary steps that should be performed before applying a splint to an extremity include the following:

- Review the facility/unit-specific protocol for splinting, if one is available.
- Review the treating clinician’s order for splinting.
  - Note the purpose of the splint (e.g., the type of injury), the area to be splinted, the type of splint to be used, and any wound care required or analgesic to be administered before application of the splint.
- Verify completion of facility informed consent documents.
  - Typically, the general consent for treatment that is executed by patients on admission to a healthcare facility includes standard provisions that encompass splinting.
- Review the patient’s medical history/medical record for any allergies (e.g., latex, medications, or other substances); use alternative materials, as appropriate.

Gather supplies necessary for applying a splint, which typically include the following:

- Nonsterile gloves and additional personal protective equipment (PPE; e.g., gown, mask, eye protection) if exposure to body fluids is anticipated.
- Vital signs monitoring equipment.
- Age-appropriate, facility-approved pain assessment tool.
- Prescribed medications (e.g., analgesic, anti-anxiety medication), if indicated.
- Tape measure.
- Commercially manufactured splint, if indicated.
- Dressing for the wound, if present.
- Materials to mold and set a synthetic (e.g., fiberglass) splint, if indicated, including:
  - synthetic splinting material, which is available in rolls or thick, precut sheets.
  - padding material, if necessary, to prevent excessive pressure on tissues underlying the splint.
  - elastic bandage, Velcro straps, and/or tape to hold the splint in place.
  - basin with room temperature water.
  - towel.
- Ice (optional).
- Written information, if available, to reinforce verbal education.

**How to Apply a Splint to an Extremity**

- Perform hand hygiene and don PPE if exposure to body fluids is anticipated.
- Identify the patient according to facility protocol.
- Establish privacy by closing the door to the patient’s room and/or drawing the curtain surrounding the patient’s bed.
- Introduce yourself to the patient and family member(s), if present; explain your clinical role; assess the coping ability of the patient and family and for knowledge deficits and anxiety regarding application of splint.
  - Determine if the patient/family requires special considerations regarding communication (e.g., due to illiteracy, language barriers, or hearing impairment); make arrangements to meet these needs if they are present.
  - Use professional certified medical interpreters, either in person or via phone, when language barriers exist.
- Explain the procedure for applying a splint and its purpose; answer any questions and provide emotional support as needed.
- Encourage using anxiety-relief techniques (e.g., relaxation exercises, meditation, deep-breathing) and administer anti-anxiety medication as prescribed.
Assess the patient’s general health status, including his/her vital signs and pain level using a facility-approved pain assessment tool
  • Premedicate patient with prescribed analgesic; allow for therapeutic level to be reached before beginning the splinting procedure
  • Position the patient for privacy, comfort, and accessibility; raise bed to a height that is optimal for access to patient
  • If necessary, remove or cut away the patient’s clothing
  • Remove any jewelry or accessories from the affected limb
  • Assess the site of the injury, avoiding unnecessary movement of the fracture site or site of dislocation to minimize pain and potential damage to soft tissue and blood vessels
    • Perform neurovascular assessment (for details, see below)
    • Ask the patient if he/she can move the affected extremity
  • Apply a dressing to any wounds on the affected limb
  • Apply the splint according to orders of the treating clinician, facility protocol, and manufacturer’s instructions
    • Measure the area to be splinted
    • Evaluate the chosen splint to determine if it will fit. Depending on the type of splint, adjust the material to the size necessary to extend across the joint(s) that is next to the affected area
      –Be aware that some splints are made for right or left limbs or right or left sides of a limb
    • If the splint does not have a padded inner lining, wrap the area to be splinted with padding material to minimize risk for friction-related soft tissue injury
    • Secure the splint with elastic bandages, Velcro straps, and/or tape
  • Assess patient comfort with the applied splint
  • Apply ice to the site, if ordered, to ameliorate pain and swelling
  • Frequently re-evaluate
    • the patient’s vital signs to assess for shock, which may result from fracture-related blood loss
    • the patient’s neurovascular status at the site of the splint using the previous, initial neurovascular assessment as a baseline
      –Perform neurovascular assessments according to facility protocol, typically every 1–2 hours for the first 24 hours
        - Complete assessments in both affected and unaffected extremities and compare findings
        - Assess for pain in the affected extremity using a facility-approved pain scale. Ask about onset and location of pain
        - Assess the color and temperature of the affected extremity. Observe for pallor or cyanosis. Use the back of the hand to evaluate skin temperature
        - Evaluate capillary refill by applying pressure for 2–3 seconds to the nailbeds of the affected extremity until blanching occurs. Upon release, nailbeds should return to normal within 3 seconds or less. Compare with unaffected extremity
        - Palpate for the presence of a pulse, checking the unaffected extremity first and comparing it with the affected extremity
          - Contact the treating clinician immediately if the pulse is absent as this indicates vascular impairment in the affected extremity
        - Assess for a paresthesia including tingling, numbness, burning sensation, decreased sensation, or feeling of “pins and needles” in the affected extremity by lightly touching proximal and distal to the affected area. Assess unaffected extremity and compare findings
        - Evaluate the affected extremity for paralysis. Ask the patient to move the extremity distal to the affected area (i.e., extending and flexing fingers and wrist)
        - Assess the affected extremity for swelling. Ask the patient if he or she is experiencing any tightness or pressure. Assess unaffected extremity and compare findings
    • the fit of the splint and the patient’s skin condition under the splint
    • the patient’s comfort/pain level
  • Dispose of used procedure materials and perform hand hygiene
  • Update the patient’s plan of care, as appropriate, and document application of the splint in the patient’s medical record, including the following information:
    • Date and time the splint was applied
    • Description of the procedure, including materials/type of splint used and any medications that were administered
Patient assessment findings, such as
- level of pain before and after administration of analgesic, if appropriate
- level of anxiety
- neurovascular status of the affected limb
- skin condition

- Patient’s response to splinting, including pain/discomfort during and immediately following the procedure
- Any unexpected patient events or outcomes, interventions performed, and whether or not the treating clinician was notified
- Patient/family member education, including topics presented, response to education provided/discussed, plan for follow-up education, and details regarding any barriers to communication and/or techniques that promoted successful communication

Other Tests, Treatments, or Procedures That May Be Necessary Before or After Applying a Splint to an Extremity

› Before application of the splint, assess neurovascular status to establish a baseline for subsequent assessment (for details, see How to Apply a Splint to an Extremity, above)
› Repeat the neurovascular assessment after splinting and periodically thereafter according to the treating clinician’s orders and/or facility protocols. Neurovascular compromise is not always immediately apparent and regular assessment is important

What to Expect After Applying a Splint to an Extremity

› The patient does not experience unnecessary pain
› The patient does not sustain further tissue injury at the affected site
› The area of injury is supported and immobilized in correct alignment
› Adequate circulation is maintained to the wounded tissue and to the extremity distal to the wounded area
› The patient experiences no skin breakdown related to splinting
› The patient and family verbalize understanding of required follow-up care of the injured area and the splint

Red Flags

› Pain, numbness, or decreasing mobility in soft tissues and/or joints of the affected limb, and/or coolness, pallor, or cyanosis of extremity skin distal to the affected area may develop, suggesting circulatory compromise and/or nerve compression from excessive constriction of the soft tissues of the limb
  • Contact the treating clinician and administer prescribed treatment, which typically involves loosening or removal of the splint and monitoring for resolution of symptoms
› If bleeding under the splint develops (e.g., as evidenced by bloody or serosanguinous drainage seeping out of the splint or absorbed into splint materials), contact the treating clinician and administer prescribed treatment. Treatment typically involves removal of the splint, evaluation and treatment of the underlying wound, replacement of the splint, and ongoing observation for fresh bleeding
  • A potential complication of fracture is the development of a fat embolism; signs and symptoms include dyspnea, agitation, hypoxia, altered mental status, and a petechial rash

What Do I Need to Tell the Patient/Patient’s Family?

› Educate the patient and/or family about what to expect during and after splint application. Encourage questions
› If laboratory testing or other diagnostic procedures (e.g., X-ray of the affected extremity) are ordered, explain how these procedures are performed and when the results will likely become available
› If the patient is cared for at home or will be discharged to home after the splint is applied, educate to promote adherence to the prescribed treatment regimen to promote healing. Patient/family education should include
  • how to contact the treating clinician if questions or problems arise
  • information on mobility, including that mobility will be impaired if the joint is splinted
  • the need to report to the treating clinician (or seek immediate medical attention) the development of increasing pain, decreased joint mobility, and/or numbness, coolness, or paleness of the part of the limb that extends beyond the splint
  • keeping the splint in place (with the exception of bathing) and dry until a healthcare clinician removes it
› Explain the importance of keeping follow-up medical appointments to allow continued medical surveillance of the patient’s condition
References


