

# **SPLINTING GUIDE FOR EMS/HOSPITAL PROVIDERS**

## **INTRODUCTION** (LOUIS SPINA M.D., 9/2016)

Splints can be applied to most pediatric fractures, dislocations and sprains. Splints may also aid in the immobilization of soft tissue injuries such as fingertip amputations and lacerations over joints where it is important to minimize tension or damage to the healing injury.

Immobilization can decrease pain and bleeding as well as prevent further vascular, nerve and soft tissue damage. Unlike casts, which are circumferential, splints allow for swelling in the immediate post injury phase and can reduce the possibility of compartment syndrome. They can be used the primary modality for immobilization during the healing phase of an injury and can be used temporarily until swelling resolved and a cast can be placed definitively.

Many recent studies in the pediatrics have demonstrated that removable splints for minor injuries such as torus fractures provide a faster return to baseline function when compared to traditional casting.

Temporary splints from transport can be used by emergency medical services. Splints can be made from a variety of materials. The most common form is plaster of Paris (powdered gypsum impregnated in gauze. This has the benefit of being inexpensive and customized to the patient. Plaster typically sets in 2-8 minutes but does not reach maximum strength until 24 hours. Malleable aluminum, air and synthetic splinting materials may also be used (e.g. Fiber glass, Orthoglass). Synthetic splinting materials are more difficult to mold and more expensive. However, they are lighter, set more quickly and are water resistant.

Preformed splints for common uses are more readily available (e.g. thumb spica). There preformed splints come in a variety of sizes but the appropriate size may not be available for smaller children. Preformed splints do not provide the same degree of immobilization as custom splints. Custom splints should be utilized when precise and continuous immobilization is required.

## **EQUIPMENT**

1. Stockinet (optional)
2. Plaster or fiberglass splinting/casting material
3. Webril (splint padding)
4. Warm water (room temperature)
5. Elastic wrap, Tape, Sling

## **COMPLICATIONS**

Cutaneous: pressure sores/necrosis, infection, thermal burns  
Neurovascular compromise

**PROCEDURE: SPLINTING**

|          |  |
|----------|--|
| PREPARE  | Clean, repair and dress any skin lesions prior to splinting<br>Consider removing clothing that will not be able to be removed after<br>Evaluate neurovascular status   |
| SELECT   | Appropriate splint type (See table below)  |
| LENGTH   | Use unaffected extremity to measure the materials<br>In general, the plaster is used to immobilize the joint above and joint below the injured area, if this is anatomically possible<br>The stockinet should be longer than the splinting material so that it can be rolled over the ends of the splints.<br>Cut dry plaster or fiberglass to fit area to be splinted. Plaster of Paris should be slightly longer than needed as it retracts during setting   |
| WIDTH    | The size of the plaster used is measured to cover approximately 50% of the circumference of the injured extremity. In an adult, this generally means 2 inch for the fingers, 3-4 inches for the upper extremity and 5-6 inches for the lower extremity   |
| LAYERS   | In an average sized adult, upper extremities should be splinted with 8-10 layers of plaster. Lower extremities generally require 12-14 layers.   |
| PADDING  | Roll Webril around stockinet. This should be about 2-3 layers thick & each turn should overlap the previous turn's with by 25-50% of its thickness.<br>Alternatively, layers of Webril (approximately ½ the number of layers as the plaster & the same diameter as the plaster) may be used<br>One additional layer of Webril is placed on the outside of the plaster (non-skin side) to avoid sticking of the elastic wrap to the plaster.<br>Place additional padding (Webril) over boney prominences (such as the ankle malleoli) to avoid pressure injuries. |
| POSITION | In general, splints are prepared to immobilize the effective limb in a position of function. See individual splints to follow. There are exceptions to this rule. 5 <sup>th</sup> metacarpal neck fractures are position with the 5 <sup>th</sup> MCP at 70-90 degrees. Distal finger extensor tendon avulsion leading to Mallet deformity are splinted in extension   |
| WET      | Wet plaster/fiberglass material (not the padding)<br>Plaster of Paris and water create an exothermic reaction. The water should be at room temperature (ideally at 24° C) The plaster drying rate is directly related to water temperature. The colder the water, the longer the drying time. As the water temperature approaches 40° C, the potential for serious burns from the splint doubles.<br>Squeeze out excess water. Lie the plaster on a flat surface and smooth out any lumps or wrinkles  |
| APPLY    | The Webril-lined splint is then positioned over the area to be immobilized<br>Perform initial splint shaping at large joints. secured with an ACE wrap.<br>Shape splint contours to final form.<br>Maintain splint positioning until it has completely hardened.   |
| FINISH   | Re-evaluate and document neurovascular status<br>Provide a sling for comfort (upper extremity) or crutches (lower extremity)   |

## SPLINT AFTERCARE

The patient or parent should be advised to avoid wetting the splint and to not to place any objects between the skin and the splint. The lower end of the splint should be elevated to avoid further swelling. For example, a sling on the upper extremity should be position so that the hand is above the level of the elbow. For lower extremity splints the foot should be elevated on a chair if sitting or a pillow if lying. Ice can be applied to the outside of the splint for pain but no longer than 15-20 minutes.

They should return urgently for worsening pain under or distal to the splint. Numbness or paresthesias. Follow up should be arranged within a week with an orthopedist

| <b>SPLINT SELECTION</b> |                       |  |   |
|-------------------------|-----------------------|--|---|
|                         | SPLINT                | INDICATION   | COMMENTS  |
| Upper Extremity Splints | Colle's/Volar         | Distal forearm   | Alternative to sugar tong (not for young children)  |
|                         | Long arm Gutter       | Wrist, forearm<br>Metacarpal<br>Proximal phalanx           | Radial for 2 <sup>nd</sup> /3 <sup>rd</sup> digits<br>Ulnar for 4 <sup>th</sup> /5 <sup>th</sup> digits |
|                         | Sugar tong            | Elbow<br>Proximal humerus<br>Distal                        | Useful for most upper extremity fractures<br><i>Must use sling</i>                                      |
|                         | Thumb spica           | 1 <sup>st</sup> metacarpal<br>Proximal phalanx<br>Scaphoid |   |
| Lower Extremity Splints | Long leg              | Distal femur<br>Proximal tibia/fibula                      | Crutches for children over 6 years  |
|                         | Posterior (short) leg | Distal tibia/fibula<br>Foot<br>Ankle                       | Crutches for children over 6 years  |
|                         | Stirrup               | Ankle (including soft tissue injuries)                     | Allows for weight bearing<br>Fits in shoe   |

## RADIAL/ ULNAR GUTTER

### INDICATIONS

Metacarpal and/or proximal phalangeal fractures.

*Ulnar* gutter splint immobilizes the plain of 4th and 5th digits.

*Radial* gutter splint immobilizes plain of 2nd and 3rd digits.

### DIMENSIONS

*Width* to wrap to midline of the hand on dorsal & volar surfaces.

*Length* to extend from the nail base to the proximal forearm.

### POSITIONING

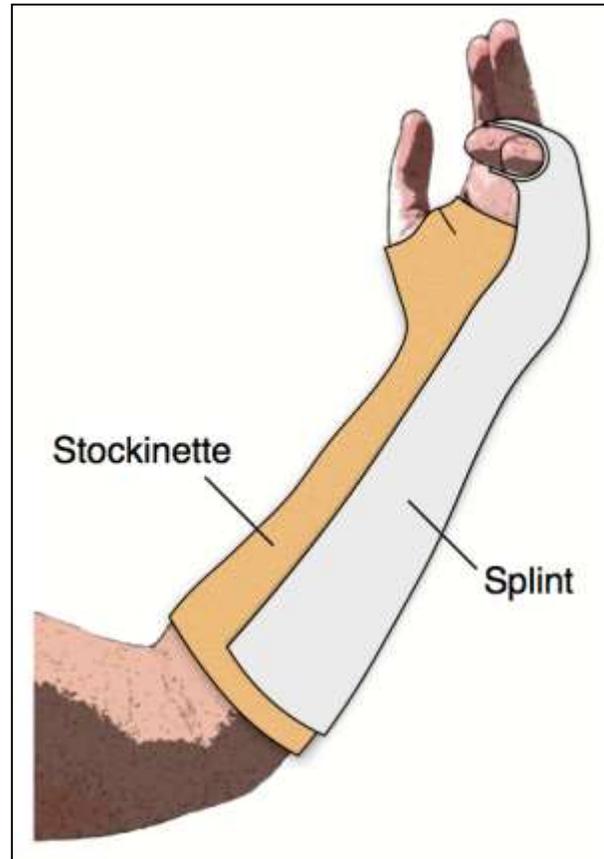
Position patient with forearm vertically erect.

Shape the splint as follows:  
Wrist in neutral position  
M-P joints in 70° flexion.  
P-I-P joints in 20-30° flexion.

### COMMENTS

A thin layer of padding should be placed between the fingers to prevent irritation.

Using a sling is optional to keep arm elevated (not feasible in toddlers & infants)



## THUMB SPICA

### INDICATIONS

A thumb spica splint is essentially a radial gutter splint adapted for immobilization of the thumb.

Indicated for:

Nondisplaced fractures of the first metacarpal bone.

Nondisplaced fractures of the proximal phalynx of the thumb.

Scaphoid fractures.

Sprain of the ulna collateral ligament

### DIMENSIONS

Dimensions are the same as for a radial/ulnar gutter splint.

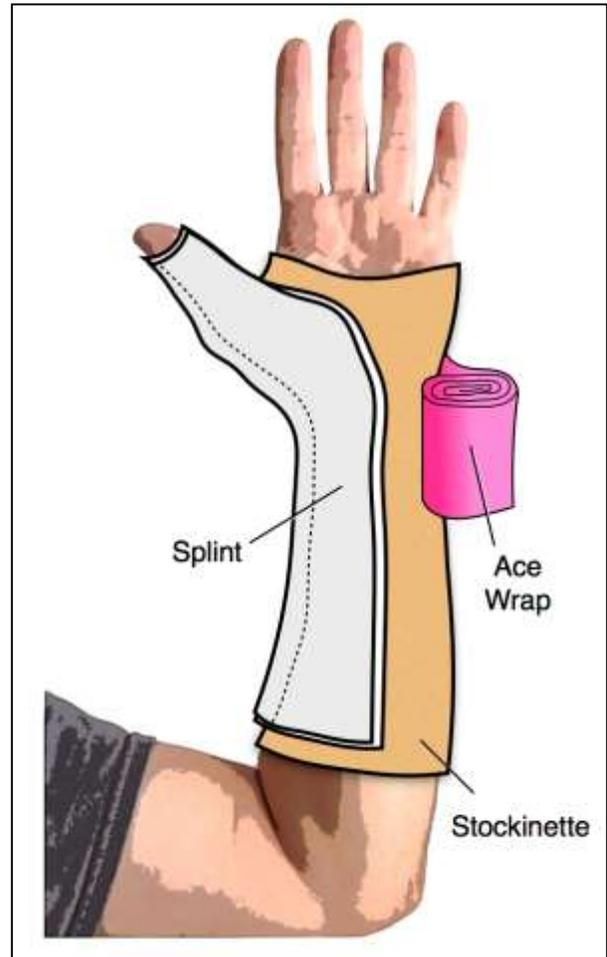
### POSITIONING

Wrist in neutral position.

Thumb abducted & in slight flexion at the M-P and I-P joints.

### COMMENTS

May also make small cuts in plaster/fiberglass on both sides at the base of the thumb to make it easier to wrap around thumb



## VOLAR /COLLES

### INDICATIONS

Distal forearm and wrist fractures.  
Also immobilizes the plane of the 2nd and 3rd digits.

### DIMENSIONS

*Width* to fully cover volar aspect of the forearm.

*Length* to extend from proximal fingers to proximal forearm along volar side of forearm.

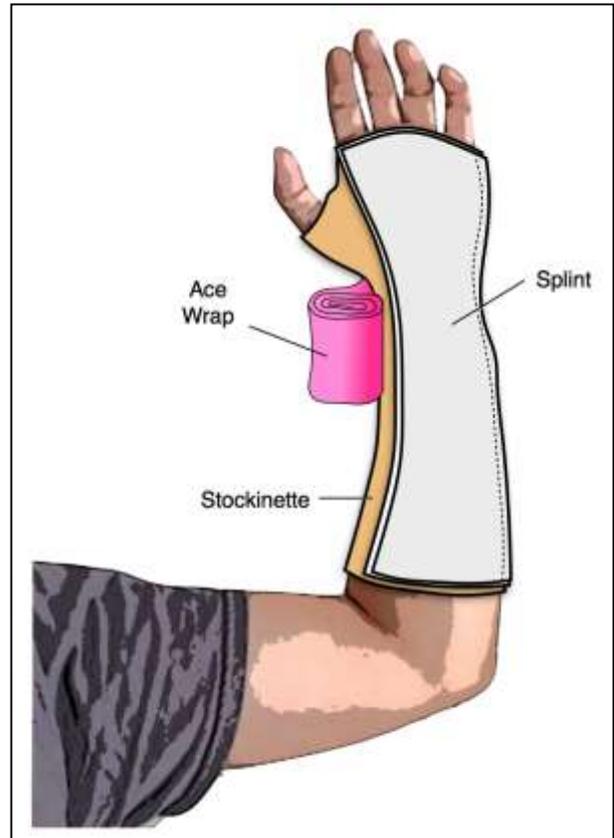
### POSITIONING

Position wrist in neutral position and digits slightly flexed at all joints.

### COMMENTS

Using a sling is optional to keep arm elevated (not feasible in toddlers & infants)

May be extended to distal fingertips for distal finger fractures or metacarpal fractures of the fingers/metacarpals 2-4.



## LONG ARM POSTERIOR

### INDICATION

Used for stable injuries in the elbow region. For example, the patient with elbow pain in which no obvious fracture is seen but a joint effusion is present as evidence by an enlarged posterior fat pad. (Orthopedic consults are needed for supracondylar fractures)

### DIMENSIONS

*Width* to cover  $\frac{1}{2}$  the arm circumference.  
*Length* to extend from the dorsal aspect of the mid-upper arm, over the olecranon, and down the ulnar aspect of the arm to the distal palmar flexion crease.

### POSITIONING

Position the child on his/her stomach with injured arm hanging off stretcher with elbow at  $90^\circ$  angle

After plaster/fiberglass is applied, shape the splint with elbow flexed at  $90^\circ$  and forearm in neutral position.

### COMMENTS

To ensure comfort, provide extra padding to any bony prominence.

A sling must be worn to support the arm because many casting materials cannot maintain the  $90^\circ$  angle needed at the elbow.



## SUGAR TONG (ARM)

### INDICATIONS

Broad range of uses.

*Proximally*, it can be used for stable humerus fractures.

*Distally*, frequently used for stable forearm and wrist fractures – provides the most effective immobilization in these areas.

A double sugar tong (both proximal and distal at a 90 degree angle at the elbow) can be used to immobilize elbow injuries.

### DIMENSIONS

*Width* of the distal splint should slightly overlap the radial and ulnar edges of the arm.

*Length* should extend from the dorsal aspect of the knuckles, around the elbow, to the volar palmar flexion crease.

### POSITIONING

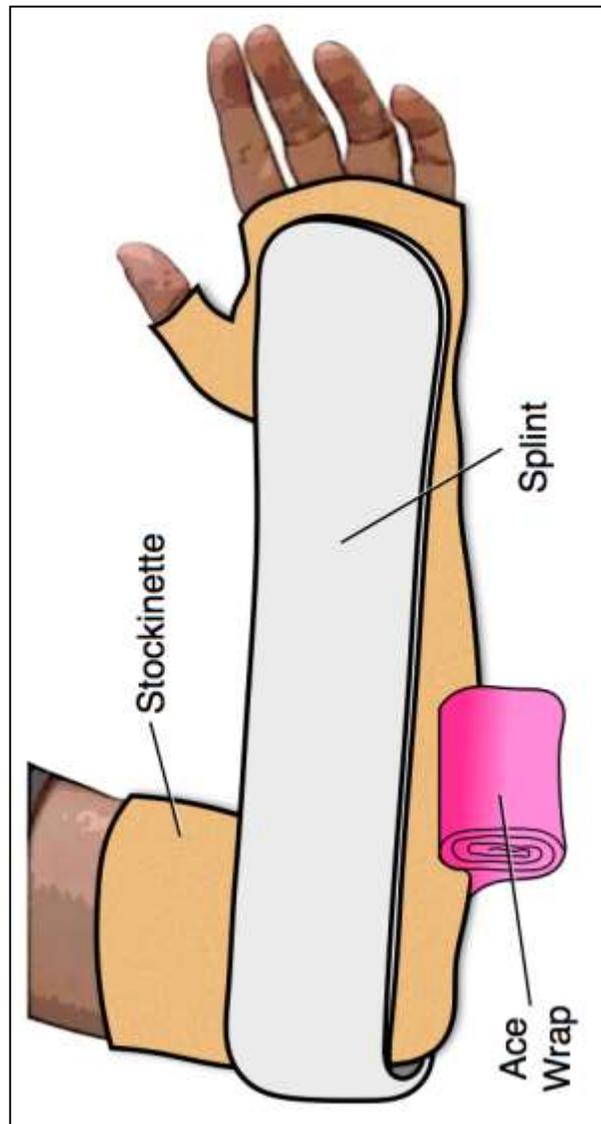
Position the child on his/her stomach with injured arm hanging off stretcher with elbow at 90° angle

After plaster/fiberglass & overwrap is applied, shape splint and keep elbow flexed at 90° with the wrist in neutral position.

### COMMENTS

A sling is necessary to support the sugar tong at the elbow.

Analogous to a ankle stirrup splint



## POSTERIOR / SHORT LEG

### INDICATIONS

Provides support for injuries in:  
Distal tibia/fibula  
Ankle  
Foot

### DIMENSIONS

*Width* should cover at least  $\frac{1}{2}$  the leg circumference.  
*Length* should extend posteriorly from level of the fibular neck over the heel of the foot to the base of the toes.

### POSITIONING

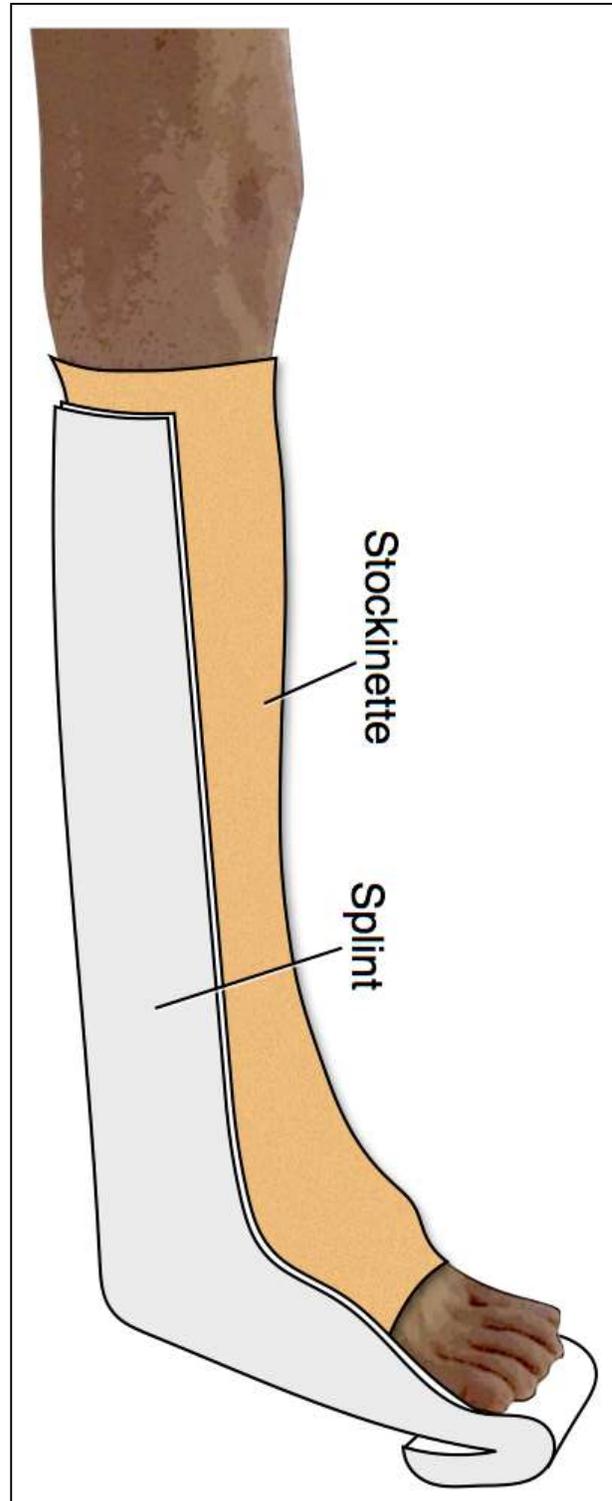
To apply, position child prone on a stretcher with knee flexed at 90 degrees. The foot should be placed in neutral position at 90° to the leg.

### COMMENTS

Provide extra padding at bony prominences before adding plaster/fiberglass layer.

Avoid pressure at fibular neck to prevent compression of peroneal nerve.

Crutches are indicated for ambulation except for children under 6 years of age.



## STIRRUP (LEG)

### INDICATIONS

Provide lateral support for ankle fractures or soft tissue injuries, preventing inversion and eversion.

Often used in addition to posterior splints to stabilize ankle fractures.

### DIMENSIONS

*Width* to cover at least  $\frac{1}{2}$  the leg circumference.

*Length* to extend medio-laterally from just below the fibular head, around the heel and ending just below the medial aspect of the knee.

### POSITIONING

To apply, position child prone on a stretcher with knee flexed at 90 degrees. The foot should be placed in neutral position at 90° to the leg.

### COMMENTS

These splints conveniently fit into a loose shoe.

They allow weight bearing to be initiated.

Crutches should be provided if full weight-bearing is contraindicated.

