Acute Care Splinting & Casting

FACULTY:
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Pay attention

- Open Fractures
- Compartment Syndrome
- Necrotizing Fasciitis
- Long Bone Fractures
- Dislocations – Hip, Knee, Ankle, Shoulder
  Fx/Dislocation

Disclosure

- Tom Gocke, MS, ATC, PA-C, DFAAPA
  - AAPA – Intellectual Property
  - Orthopaedic Educational Services, Inc. – Owner/Royalties/Intellectual Property
- Travis Randolph, MPAS, ATC, PA-C
  - No disclosures
- Stephanie Stradley, PA-C
  - No disclosures

Learning Objectives

At the conclusion of this session, participants should be able to:

- ***Appropriately apply splint-padding materials for swelling reduction and skin protection***
- ***Appropriately apply fiberglass splinting material to upper and lower extremity injuries***
- ***Select the appropriate acute care splint for immobilization***
- ***Apply the following basic acute care splints for common upper extremity injuries: thumb spica splint, volar wrist splint, sugar tong splint, long arm splint, and ulnar gutter splint***
- ***Apply the following basic acute care splints for common lower extremity injuries: low leg posterior splint and low leg stirrup (sugar tong) splint***
- ***Appropriately apply cast-padding materials for swelling reduction and skin protection***
- ***Appropriately apply fiberglass cast material to upper and lower extremity injuries***
- ***Apply the following basic casts for common upper and lower extremity injuries: short arm cast and short leg cast***

STRAIGHT casts lead to CROOKED BONES
And
CROOKED casts led to STRAIGHT BONES

Splinting Materials

Stockinette

- Cut stockinette over concave surfaces to avoid wrinkles which may cause skin sore

Padding

- Apply soft roll with 50% overlap in 2 layers
- Avoid applying too much soft roll that could lead to wrinkles
- Tear pieces of soft-roll to pad over bony prominences to avoid excessive padding over flexion creases (circumferential vs. layer padding)

Positioning

- Avoid excessive joint movement once padding has been applied to limit wrinkles and increase pressure over Neurovascular structures
- Maintain neutral dorsiflexion of ankle when casting/splinting the lower extremity
- Use intrinsic plus hand positioning for metacarpal/finger injuries
  - MCP's flexed 70-90 degrees
  - IP's in extension
    - This position takes advantage of ligamentotaxsis to help maintain fx alignment and avoid over tightening (contractures) of the phalangeal collateral ligaments

Splinting Materials

- Water
  - Avoid excessively warm/hot water- this can accelerate the set up time for fiberglass/plaster splint materials. Also can increase material temps rapidly causing skin burns
  - Using cool water will allow for more molding time
  - Too many layers of fiberglass splint/cast material will cause excessive heat
  - Plaster will contract after immersed in water
  - Fiberglass could expand after immersed in water

- Splinting/Casting:
  - Cover/pad cut Fiberglass edges as they can become sharp and lead to abrasion of cuts
  - Use caution when applying elastic wraps/elastic tape as it can lead to increase external compression leading to:
    - Pain
    - Compartment syndrome symptoms
    - Circulatory restriction
  - Use 3 point molding techniques to maintain fracture reductions
  - Cut out triangle in splinting materials to avoid excessive splint material over flexed joint. (i.e.: intrinsic plus position)

Splinting Materials

- Caring for Splint/Cast
  - NEVER REMOVE CAST/SPLINT unless instructed to do so by treating provider
  - NEVER stick any object inside the splint/cast as it can cause skin injuries
  - It is OK to apply ice packs over the splint/cast to help control pain and swelling
  - Apply ice packs 4-5 times/day, for 20-30 min each time for 7-10 days.
  - DO NOT SLEEP with ice applied to an injured area
  - Elevate injured extremity for the first 72 hours to help minimize swelling
  - Cover your splint/cast with a plastic bag for showers or a bath. Do not immerse your splint/cast in water unless it has a water resistive protective bag. (Example: XeroSock)
  - If you experience any of the following symptoms/problems with your splint/cast, CALL OUR OFFICE IMMEDIATELY XXX-XXX-XXXX
    - Numbness or tingling that is not relieved by elevating your effected extremity for 30 min.
    - New onset of or progressive worsen pain not relieved with rest-ice-elevation and pain meds
    - Loss of finger/toe motion
    - Excessive swelling not relieved with elevation/ice
    - Splint/cast feeling too tight or too loose
    - Splint/cast become soaking wet
    - Splint/cast becomes damaged or wears out
    - Splint/cast gets soiled with feces or urine (blood)

Upper Extremity Splints

- Volar Wrist Splint
- Thumb Spica Splint
- Ulnar Gutter Splint
- Sugar-tong Splint
- Long arm posterior Splint

Padding Techniques

Roll-on Splint padding

Layered Splint padding

VOLAR WRIST SPLINT

VOLAR WRIST SPLINT

Uses:

- **Fracture/Dislocation: Wrist/Hand/Fingers/Distal Forearm**
- **Sprain Wrist/Hand**
- **Contusion/Edema: Wrist/Hand/Fingers/Distal Forearm**
- **Laceration/Infection: Wrist/Hand/Fingers/Distal Forearm**

Volar Wrist Splint

- **Cast Padding**
  - **Layered – 10 thicknesses**
  - **Rolled – 2-3 layers**
  - **Extra padding for bony prominences**
  - **Measure from Long finger tip to 2-3 finger widths short of elbow flexor crease - Including fingers**
  - **Measure from MCP joints to 2-3 finger widths short of elbow flexor crease - No Fingers**
  - **Neurovascular checks pre and post application**
  - **Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage**
  - **Discharge instructions**

Pre-packaged splints may not have enough padding

VOLAR WRIST SPLINT

Pitfalls Volar Wrist Splint

THUMB SPICA SPLINT

THUMB SPICA SPLINT

Uses:

- **Fracture/Dislocation: Thumb IP/MCP/CMC joints**
- **Sprain: Radial-side Wrist/Thumb**
- **Contusion/Edema: Wrist/Thumb**
- **Laceration/Infection: Radial-side Wrist/Thumb**

Thumb Spica Splint

- **Splint Padding**
  - Layered – 10 thicknesses
  - Rolled – 2-3 layers
  - Extra padding for bony prominences
  - Measure from Thumb tip to 2-3 finger widths short of elbow flexor crease
  - Avoid pressure over thumb base (first dorsal compartment)
  - Neurovascular checks pre and post application
  - Secure with bias/elastic-Gauze wrap/Elastic tape
  - Discharge instructions

Pre-packaged splints may not have enough padding

Thumb Spica Padding

Roll-on padding

Layered padding

Thumb Spica Splint

- Option to include IP joint thumb
  - Warn about possible injury IP joint
  - Sports/Labor jobs

Photo courtesy TGocke, PA-C

ULNAR GUTTER SPLINT

ULNAR GUTTER SPLINT

Uses:

- **Fracture/Dislocation: Ulnar-sided Wrist/Hand/Fingers/Distal Forearm**
- **Sprain: Ulnar-sided Wrist/Hand**
- **Contusion/Edema: Ulnar-sided Wrist/Hand/Fingers/Distal Forearm**
- **Laceration/Infection: Ulnar-sided Wrist/Hand/Fingers/Distal Forearm**

ULNAR GUTTER SPLINT

- **Cast Padding**
  - **Layered – 10 thicknesses**
  - **Rolled – 2-3 layers**
  - **Extra padding for bony prominences**
  - **Measure from Long finger tip to 2-3 finger widths short of elbow flexor crease - Including fingers**
  - **Neurovascular checks pre and post application**
  - **Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage**
  - **Discharge instructions**

Pre-packaged splints may not have enough padding

Ulnar Gutter Splint

Buddy taping for Metacarpal fx can be helpful in limiting rotational deformity along with intrinsic plus positioning

ULNAR GUTTER SPLINT

Ulnar Gutter Splint

Intrinsic – Plus Position

- Use intrinsic plus hand positioning for metacarpal/finger injuries
  - MCP's flexed 70-90 degrees
  - IP's in extension
    - This position takes advantage of ligamentotaxsis to help maintain fx alignment and avoid over tightening (contractures) of the phalangeal collateral ligaments


Photo courtesy TGocke, PA-C

ULNAR GUTTER SPLINT

Photo courtesy TGocke, PA-C

Photo courtesy TGocke, PA-C

SUGAR TONG SPLINT

SUGAR TONG SPLINT

Uses:

- **Fracture/Dislocation: Wrist/Hand/Fingers/Distal Forearm/Radial Head**
- **Sprain: Wrist/Hand**
- **Contusion/Edema: Wrist/Hand/Fingers/Distal Forearm**
- **Laceration/Infection: Wrist/Hand/Fingers/Distal Forearm**

SUGAR TONG SPLINT

- **Cast Padding**
  - **Layered – 10 thicknesses**
  - **Rolled – 2-3 layers**
  - **Extra padding for bony prominences**
  - **Measure from Dorsal MCP joint, down dorsal forearm around elbow, up volar forearm to volar MCP joint**
  - **Neurovascular checks pre and post application**
  - **Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage**
  - **Sugar tong splint mandates a sling to minimize pressure on Triceps portion of elbow**
  - **Discharge instructions**

Pre-packaged splints may not have enough padding

Sugar-tong stockinette

Sugar-tong padding

Sugar-tong Splint

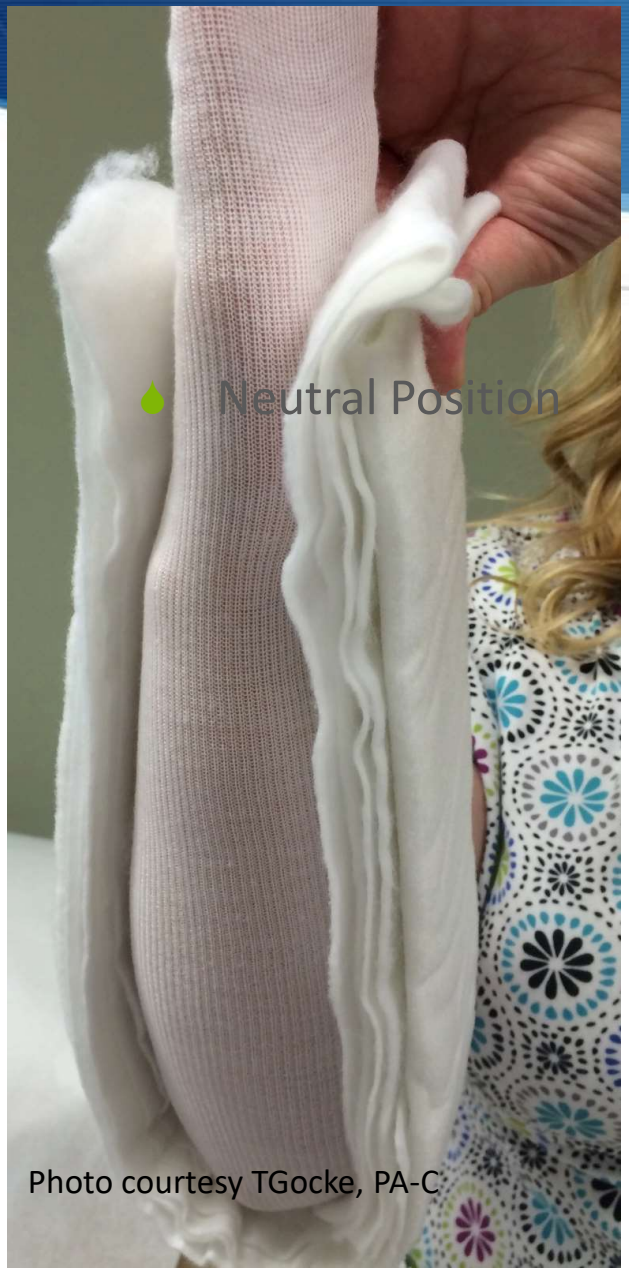


Photo courtesy TGocke, PA-C

NEUTRAL POSITION

- **SPLINT APPLICATION WRIST IN A NEUTRAL POSITION**
- **Acceptable for non-displaced/non-angulated distal radius/ulna fx**
- **X-ray findings**
  - **No dorsal Radial cortex comminution**
  - **Radial height & angle Inclination- anatomic**
  - **Ulnar negative position**

Sugar-tong Splint

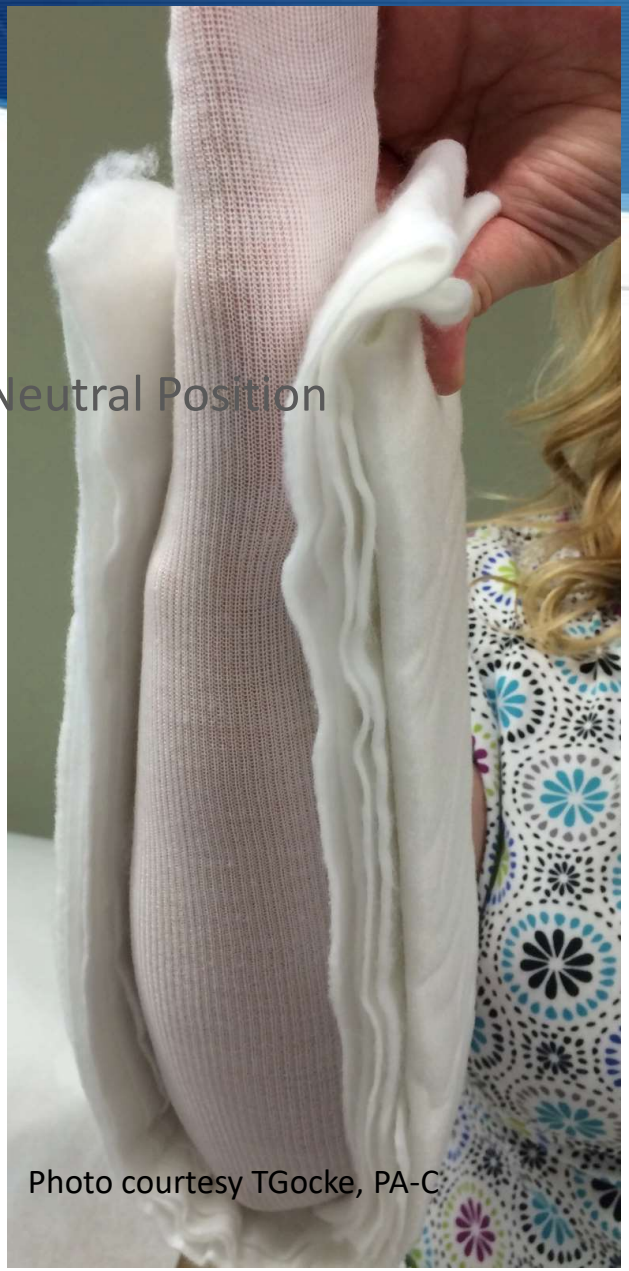


Photo courtesy TGocke, PA-C

COTTON LOADER POSITION

- SPLINT APPLICATION WRIST IN A FLEXED AND ULNAR DEVIATED POSITION
- Acceptable for non-displaced, displaced/angulated distal radius/ulna fx & radial shortening
  - Clinical position:
    - Dorsally displaced hand
    - Radial deviation
- X-ray findings
  - Radial cortex comminution
  - Radial height & angle Inclination- shortened
  - Ulnar positive position
  - Increased dorsal angle Palmar tilt

Pitfalls Sugar-tong Splint

Pitfalls Sugar-tong Splint


Photo courtesy TGocke, PA-C


Photo courtesy TGocke, PA-C


Photo courtesy TGocke, PA-C

LONG ARM POSTERIOR SPLINT

LONG ARM POSTERIOR SPLINT

Uses:

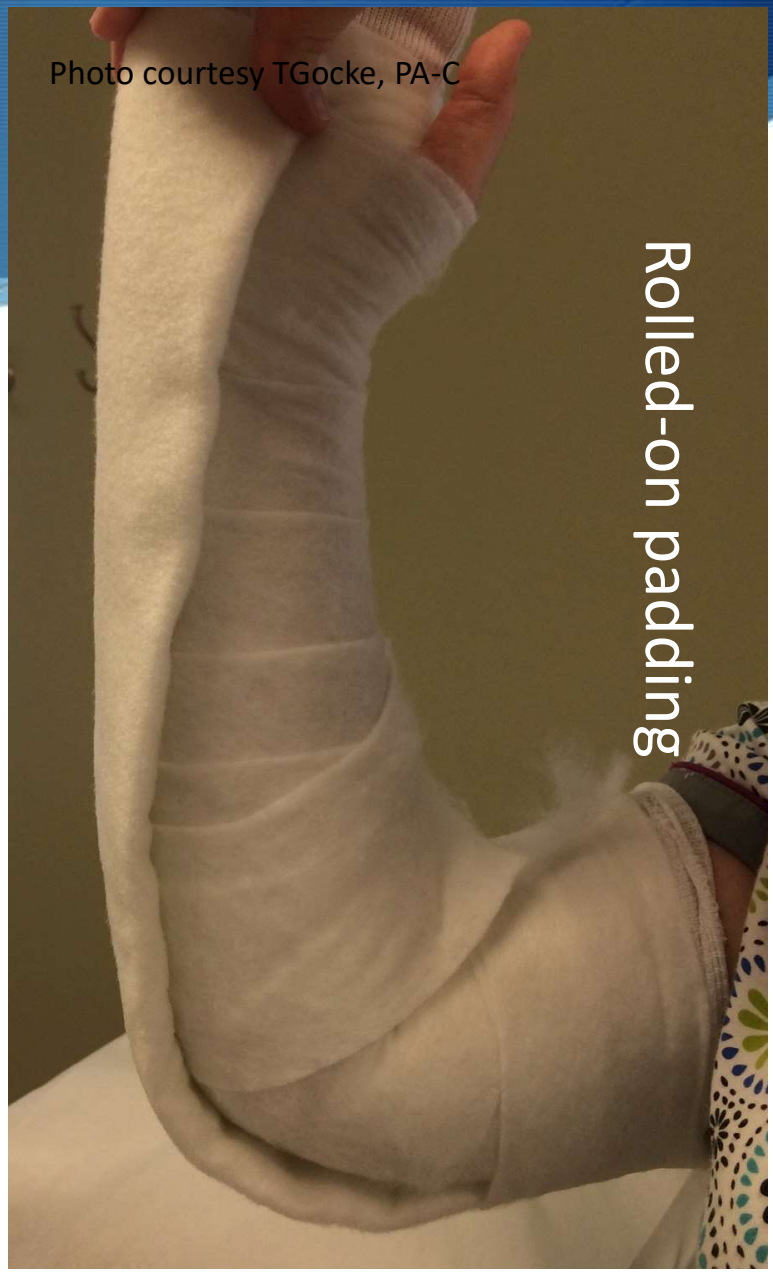
- **Forearm: Fracture/Dislocation**
- **Elbow: Fracture/dislocation**
- **Radial head: Fracture/dislocation**
- **Contusion/Edema: Forearm/Elbow**
- **Laceration/Infection: Forearm/Elbow**

LONG ARM POSTERIOR SPLINT

- **Cast Padding**
  - **Layered – 10 thicknesses**
  - **Rolled – 2-3 layers**
  - Extra padding for bony prominences
  - Measure Mid Ulnar-sided Hypothenar region up to proximal/Mid Humerus
    - Amount elbow flexion dependent on-
      - Injury location
      - Edema
      - Neuro/Vascular injury
  - Neurovascular checks pre and post application
  - Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage
  - Discharge instructions

Pre-packaged splints may not have enough padding

LONG ARM POSTERIOR SPLINT



COAPTATION SPLINT

COAPTATION SPLINT

Uses:

- **Fracture:**
  - **Supracondylar Humerus**
  - **Humerus Shaft**
  - **Proximal Humerus**

COAPTATION SPLINT

- **Cast Padding**
  - **Layered – 10 thicknesses**
  - **Rolled – 2-3 layers**
  - **Extra padding for bony prominences**
  - **Extra padding in Axilla portion of splint**
  - **Measure from High up in Axilla down medial arm, around elbow and up lateral arm up over shoulder joint (Trapezius)**
  - **Neurovascular checks pre and post application**
  - **Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage**
  - **Discharge instructions**

Pre-packaged splints may not have enough padding

Coaptation Splint

Photo courtesy TGocke, PA-C

LOWER EXTREMITY SPLINTS

Lower Extremity Splints

- **Short Leg Posterior Splint**
- **Low Leg Stirrup Splint**

LOW LEG POSTERIOR SPLINT
&
STIRRUP SPLINT

POSTERIOR LEG & STIRRUP SPLINT

Uses:

- **Fracture/Dislocation: Ankle, Foot, Tibia/Fibula**
- **Sprain: Ankle, Foot**
- **Contusion/Edema: Ankle, Foot, Low Leg**
- **Laceration/Infection: Ankle, Foot, Low Leg**

LOW LEG STIRRUP SPLINT

- **Cast Padding**
  - **Layered – 10 thicknesses**
  - **Rolled – 2-3 layers**
- **Extra padding for bony prominences**
- **Measure from Below medial Knee joint, around plantar heel & up to the fibular head laterally**
- **Foot Position:**
  - **Depends on location of injury – usually neutral ankle mortise**
- **Neurovascular checks pre and post application**
- **Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage**
- **Discharge instructions**

Pre-packaged splints may not have enough padding

LOW LEG STIRRUP SPLINT

- **Cast Padding**
  - **Stockinette**
  - **Rolled – 3-4 layers**
    - **Calcaneous needs extra padding due to high rate of pressure sore development**
- **Supine w/ Assistant Holding leg:**
  - **Assistant supports Low leg and foot, maintains ankle in neutral position**
    - **Assistant must be able to hold leg for a while**
    - **Used for Tibia & Tib/Fib fractures**
- **Supine leg over edge table:**
  - **No assistant to hold leg**
  - **Can use "kickstand" to support ankle/foot**
  - **Used for Tibia & Tib/Fib fractures**

POSTERIOR LEG & STIRRUP SPLINT

- **Prone**
  - **No assistant to hold leg**
  - **Patient must be able to move & tolerate Prone position**
  - **Used for Nondisplaced Tibia & Tib/Fib fractures, Achilles injuries**
- **Ankle/Foot Position:**
  - **Depends on location of injury**
    - **Distal Tibia apex posterior – ankle Plantar flexed position**
    - **Distal Tibia apex anterior – ankle Dorsiflexed position**
    - **Achilles Rupture – ankle Plantar flexed position**
  - **Neutral ankle position-**
    - **minimizes equines contractures on Achilles tendon**
    - **DO NOT USE FOR ACHILLES RUPTURE**

POSTERIOR LEG & STIRRUP SPLINT

- **Measure Splints**
  - **Posterior Splint**
    - **Tips of toes- across plantar foot, up calf & stop 2-3 fingers widths short of the Popliteal knee region**
  - **Stirrup Splint**
    - 2-3 finger widths below proximal Fibular head, down leg, across heel and up medial leg to 2-3 finger widths below medial Tibial flare
    - Length of Stirrup splint may vary depending on location of Tibia/Fibula fx
  - **Neurovascular checks pre and post application**
  - **Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage**
  - **Discharge instructions**

Pre-packaged splints may not have enough padding

POSTERIOR LEG & STIRRUP SPLINT

PRONE POSITION

SHORT ARM CAST
SHORT LEG CAST

SHORT ARM CAST

Uses:

- **Fracture/Dislocation: Distal Radius, Distal Ulna, Metacarpals**

SHORT ARM CAST

- Cast Padding
  - Stockinette
  - Rolled – 2-3 layers
  - Extra padding for bony prominences
  - Application:
    - Cotton-loaders position
    - Wrist neutral position
    - Keep MCP joints free
    - Extend cast 2-3 finger widths short of elbow flexor crease
    - Thenar space – contour to meet patient's anatomy
      - Cut-out or fold cast material for thenar webspace
    - Roll 2-3 layers of casting fiberglass
      - Use cool water – warm water accelerates the hardening process
      - Can lead to excessive heat – can result in skin burn (elderly)
  - Neurovascular checks pre and post application
  - Discharge instructions

SHORT ARM CAST

Photo courtesy T Randolph PA-C

Photo courtesy TRandolph, PA-C

SHORT ARM CAST

Pitfalls Short Arm cast/splint

Photo courtesy TGocke, PA-C

- Cast padding gets wet causing skin maceration
- Pressure sore 2nd to poor padding
- Foreign objects forced inside cast
- Foreign objects used to scratch dry, itchy skin
- Skin wounds/lacerations
- Cellulitis

Pitfalls Poor Splint/Cast Padding


Photo courtesy TGocke, PA-C

- **Cast padding gets wet causing skin maceration**
- Pressure sore 2nd to poor padding
- Foreign objects forced inside cast
- Foreign objects used to scratch dry, itchy skin
- Skin wounds/lacerations
- Cellulitis

SHORT LEG CAST

Uses:

- **Fracture/Dislocation: Ankle, Foot, Tibia/Fibula**
- **Sprain: Ankle**

SHORT LEG CAST

- Cast Padding
  - Stockinette
  - Rolled – 3-4 layers
- Extra padding for bony prominences
  - Calcaneous needs extra padding due to high rate of pressure sore development
- Sitting vs. Supine
  - "Kick-stand" supports foot and maintains ankle in neutral position
  - Supine position limited to non-obese, non-displaced fractures, able to lie supine
- Ankle/Foot Position:
    - Depends on location of injury – usually neutral ankle mortise
    - Neutral position- minimizes equines contractures on Achilles tendon
- Neurovascular checks pre and post application
- Secure with bias/Gauze wrap/Elastic tape/Elastic Bandage
- Discharge instructions

Pre-packaged splints may not have enough padding

SHORT LEG CAST

APPLICATION TECHNIQUES

- **SITTING**
  - Patient sitting position w/ ankle supported on “kick-stand”
  - Helps keep Ankle/Foot in neutral position
  - Heel slightly lower than Ankle Mortise
    - Get patient to lean forward – causes them to drop the heel
  - Apply Stockinette – avoid crease in dorsiflexed ankle
  - Apply 3-4 layers of roll-on padding
    - Depends on leg size and amount of padding desired
    - Extra Calcaneous padding : “boat 4x4”, cotton roll, cast padding, ABD dressing
    - Extra padding at the toes, proximal tibia
- Use 3-4-inch-wide casting tape
  - #rolls varies based on patient size
  - Reinforce foot/Heel with folded over cast tape, splint material or reinforcing strip

SHORT LEG CAST

APPLICATION TECHNIQUES

- Supine
  - Patient prone position bump under distal thigh @ knee joint
  - Assistant may need to keep knee in flexed position and passive dorsiflexion to ankle to maintain neutral position
    - If desire Plantar-flexed (PF) position assistant keeps foot in PF position
  - Apply Stockinette – avoid crease in dorsiflexed ankle
  - Apply 3-4 layers of roll-on padding
    - Depends on leg size and amount of padding desired
    - Extra Calcaneous padding : “boat 4x4”, cotton roll, cast padding, ABD dressing
    - Extra padding at the toes, proximal tibia
- Use 3-4-inch-wide casting tape
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SHORT LEG CAST

Photo courtesy TRandolph, PA-C

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SHORT LEG CAST

Photo courtesy TRandolph, PA-C

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CONCLUSION

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- Perform general assessment of injured region
- Document neurovascular status pre and post splint/cast
- Assemble assistant & all padding, splinting/casting materials
- Assure adequate padding
- Proper positioning
- Discharge instructions
- Follow up appointment
- Patient expectations/activity limitations