

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, ATC, PA-C, DFAAPA**

- 🟢 **Nothing to disclose**

***All disclosed relationships have been mitigated.**

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 ligamentotaxis 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

Photo courtesy TGocke, PA-C



Photo courtesy TGocke, PA-C



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

Photo courtesy TGocke, PA-C



Buddy taping

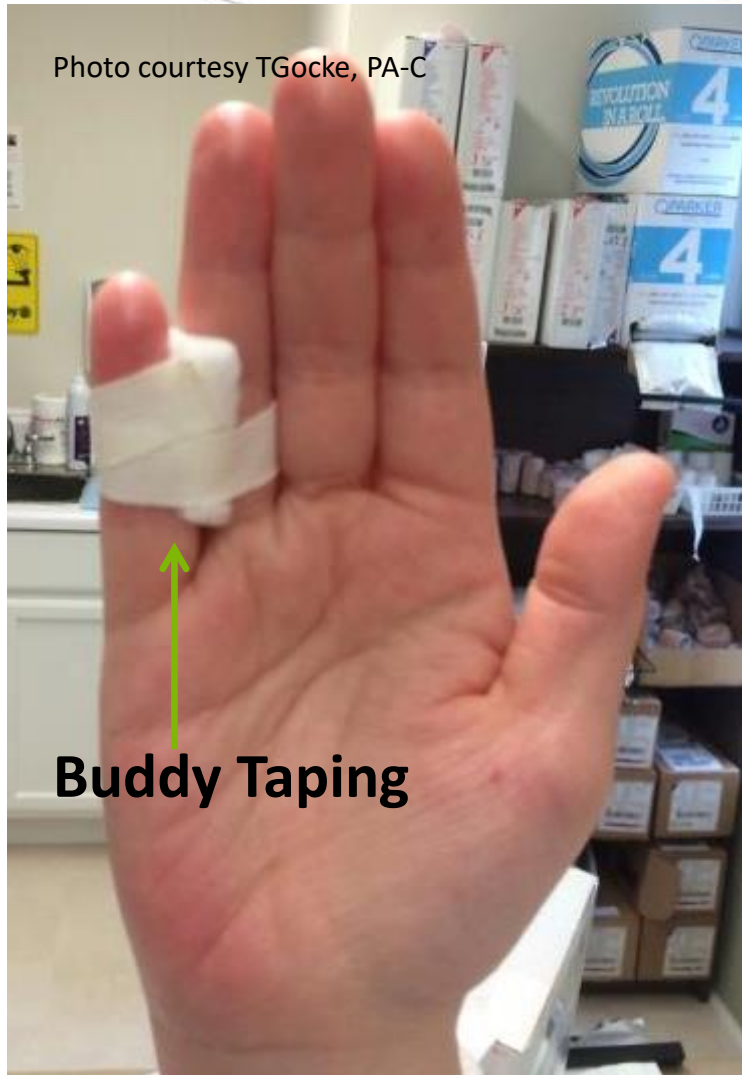


Layered padding

Photo courtesy TGocke, PA-C

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 ligamentotaxis 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



Photo courtesy TGoetze, PA-C

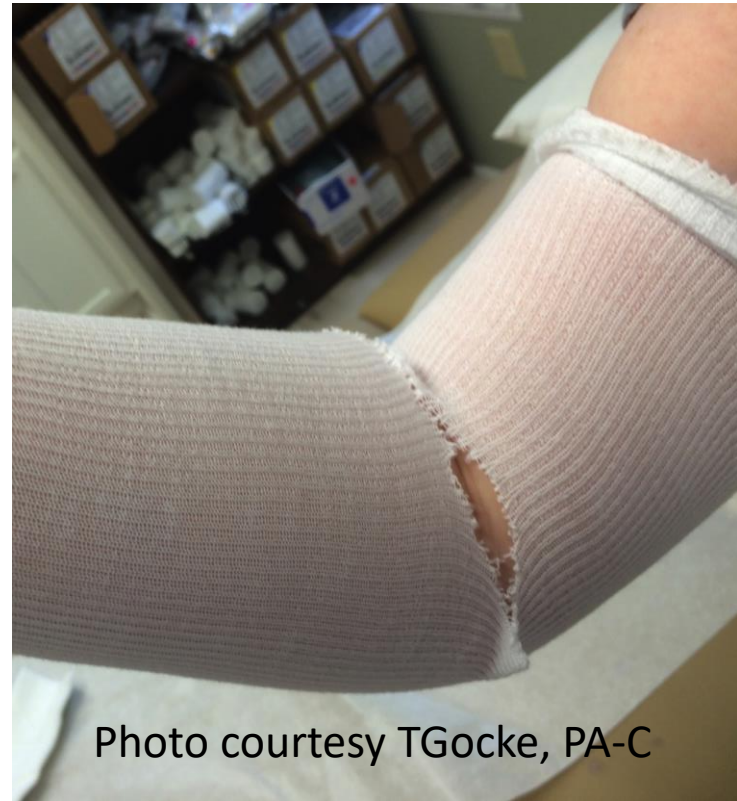


Photo courtesy TGoetze, PA-C

Sugar-tong padding

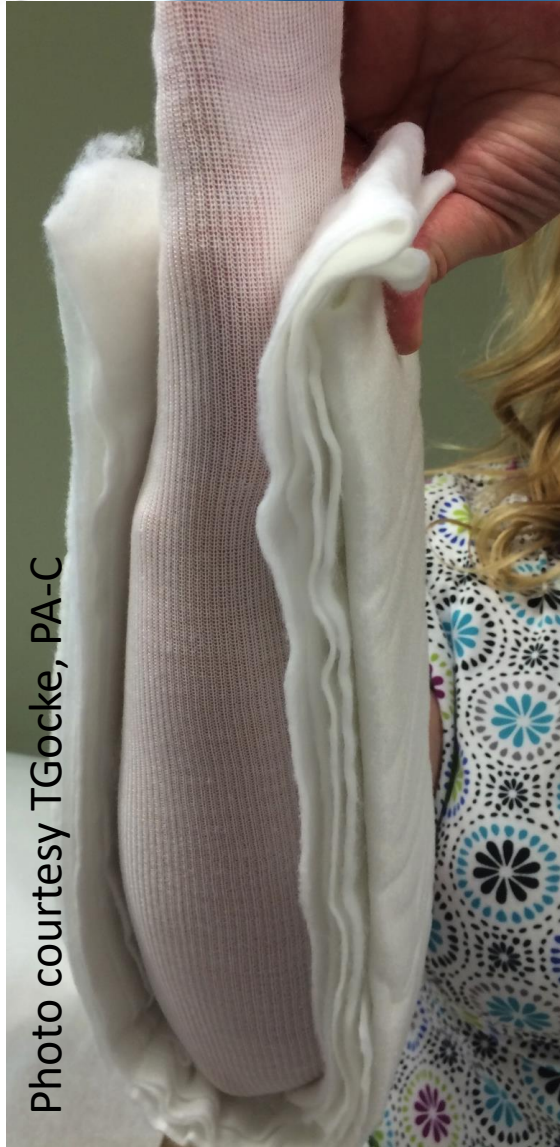
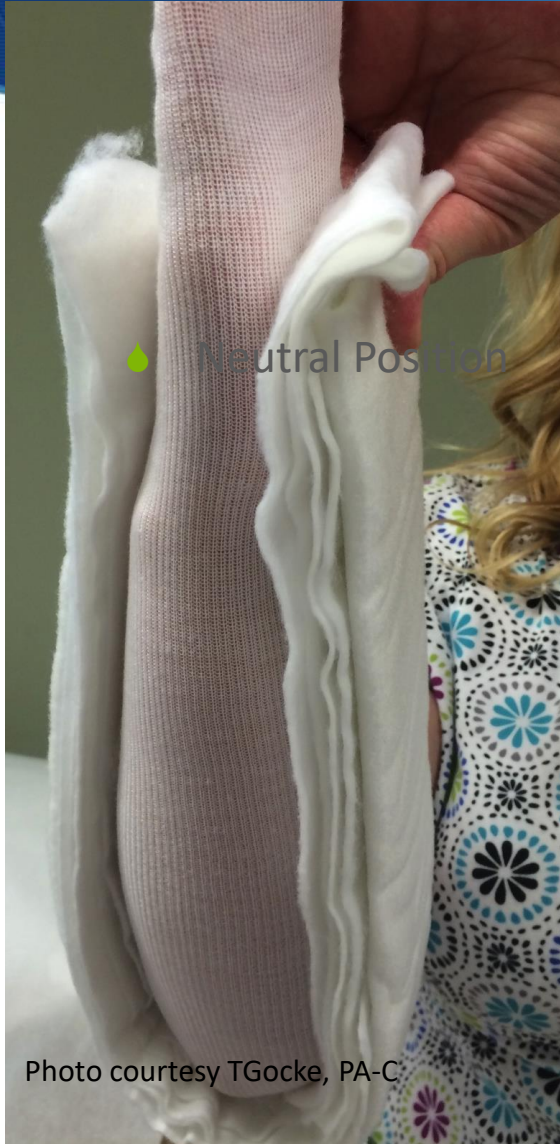


Photo courtesy TGocke, PA-C



Photo courtesy TGocke, PA-C

Sugar-tong Splint

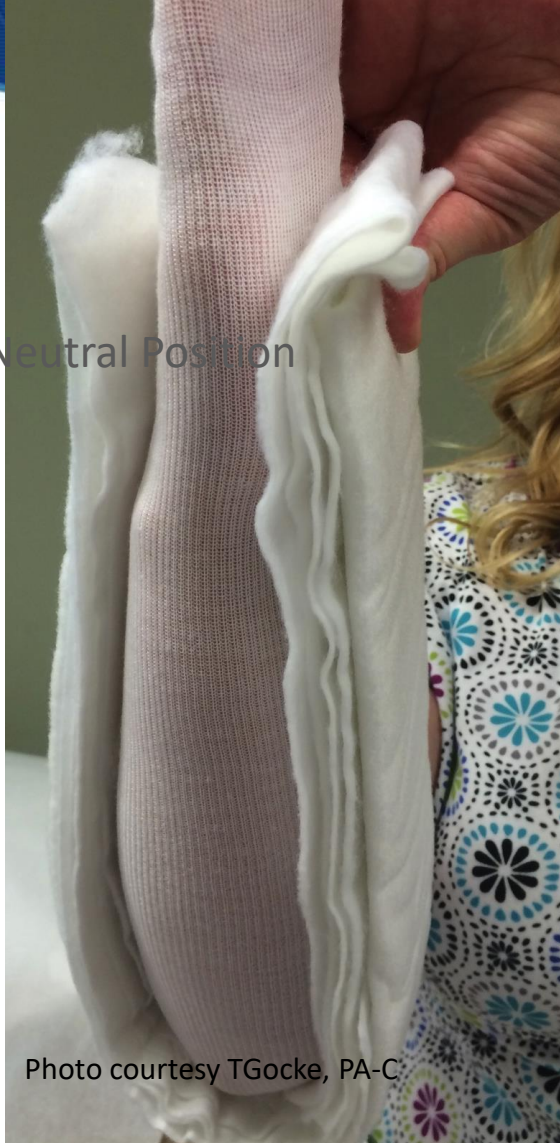


NEUTRAL POSITION

- ◆ **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**

Photo courtesy TGocke, PA-C

Sugar-tong Splint



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**

Photo courtesy TGocke, PA-C

Pitfalls Sugar-tong Splint



Photo courtesy TGocke, PA-C



Photo courtesy TGocke, PA-C

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**

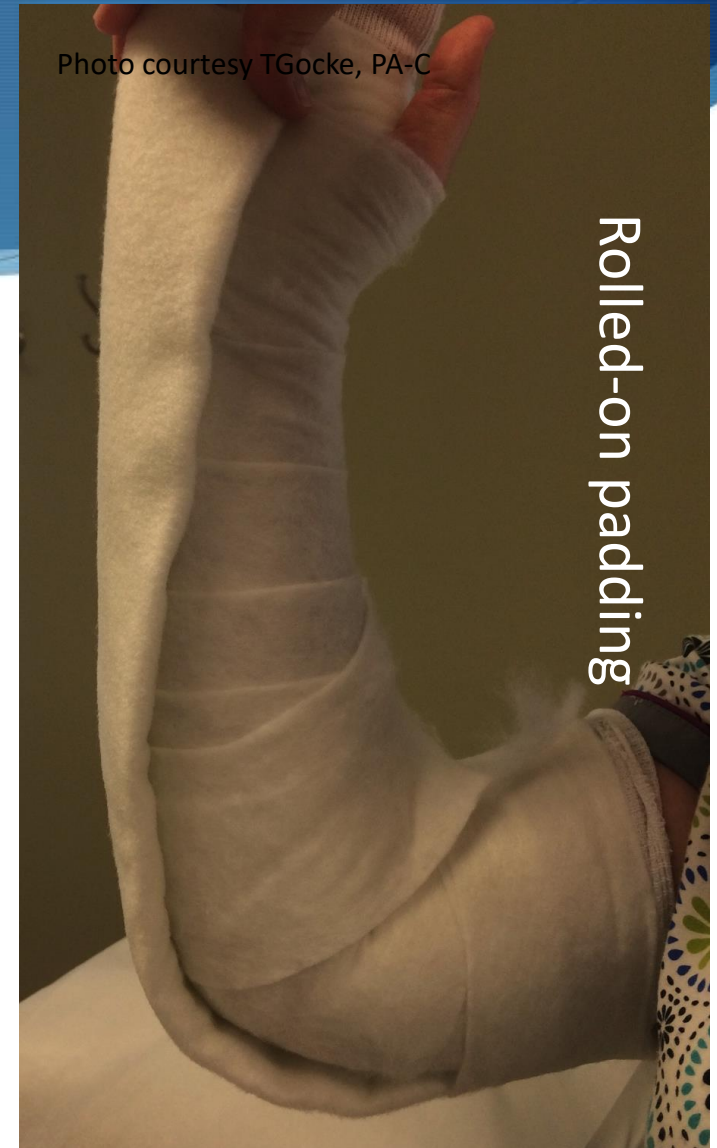
LONG ARM POSTERIOR SPLINT

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

- Calcaneus 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

Photo courtesy TRandolph, PA-C



Photo courtesy TRandolph, PA-C

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



- ▶ **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
 - Calcaneus 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 Calcaneus 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**
 - 💧 **#rolls varies based on patient size**
 - 💧 **Reinforce foot/Heel with folded over cast tape, splint material or reinforcing strip**

SHORT LEG CAST



Photo courtesy TRandolph, PA-C



Photo courtesy TRandolph, PA-C



CONCLUSION

SHORT LEG CAST



Photo courtesy TRandolph, PA-C



Photo courtesy TRandolph, PA-C

CONCLUSION

- ◆ Preform 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