

# Splinting and Casting

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Credits:

• [http://hsc.unm.edu/emered/UNMStudentWebsite/PPT\\_Presentations/Splinting%20Lecture\\_files/frame.htm](http://hsc.unm.edu/emered/UNMStudentWebsite/PPT_Presentations/Splinting%20Lecture_files/frame.htm)

• Stephanie M Chu, DO CU Sports Medicine Fellow 2008

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## Today's Goals

- What we'll cover:
  - General principles of splinting and casting – materials, indications, risks
  - Types of splints and casts – mostly upper extremity
  - Hands-on skills
  - Where to find more information
- What we cannot cover today, but you must learn :
  - Musculoskeletal exam
  - Types of bone and ligamentous injuries
  - X-ray interpretation

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## Prevalence in FM

- Orthopedic problems are 10% of all primary care visits
- 1.6% of all visits to any physician are fracture related
- 16% of all fracture care is handled by Family Physicians
- These figures are higher in rural practice

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## MS injuries are common in FM

- |                                  |                     |
|----------------------------------|---------------------|
| • <i>Finger</i>                  | • <i>Toe</i>        |
| • <i>Metacarpal</i>              | • <i>Metatarsal</i> |
| • <i>Carpal</i>                  | • <i>Ankle</i>      |
| • <i>Radius</i>                  | • <i>Fibula</i>     |
| • <i>Radial head dislocation</i> |                     |
| • <i>Humerus</i>                 |                     |
| • <i>Clavicle</i>                |                     |

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## Indications for Splinting and Casting

- Fractures
- Sprains
- Joint infections
- Tenosynovitis
- Acute arthritis / gout
- Lacerations over joints
- Puncture wounds and animal bites of the hands or feet

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## When to splint V. apply cast

- Splint to temporarily immobilize fractures, dislocations, and soft tissue injuries.
- In the acute setting, circumferential casts have increased risk of compartment syndrome and other complications
- Splints are easier to apply
- Splints allow for swelling
- Splints allow reexamination

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## References

- Essentials of Musculoskeletal Care, 3<sup>rd</sup> Edition".Griffin, L. ; Editor. Copyright 2005 American Academy of Orthopaedic Surgeons.
- Essentials of Musculoskeletal Imagin". Johnson, T & Steinbach, L; Editors. Copyright 2004 American Academy of Orthopaedic Surgeons.
- Care of the Young Athlete. Sullivan, J & Anderson, S; Editors. Copyright 2000 American Academy of Orthopaedic Surgeons and the American Academy of Pediatrics.
- Management of Fractures and Dislocations, DePalma (2-volume set, large format, atlas pictures – CLASSIC !
- Fracture Management for Primary Care, Eiff et.al. Saunders 2003
- Video course:  
<http://meds.queensu.ca/courses/assets/modules/cast-application/index.html>

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## General principles

- Immobilize a joint above and below injury
- Avoid pressure points due to:
  - Excessive molding
  - Cast indentations
- Use enough padding
  - More at bony prominence
  - Not too much at fracture site
- Consider skin wounds

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## Warning signs of ischemia

- Numbness
- Inability to move
- Discoloration distally
- Cold
- Increased pain

**Remove, loosen or split promptly !**

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## Plaster

- Made from gypsum - calcium sulfate dihydrate
- Exothermic reaction when wet - recrystallizes (can burn patient)
- Warm water - faster set, but increases risk of burns
- Fast drying - 5 - 8 minutes to set
- Extra fast-drying - 2 - 4 minutes to set - less time to mold
- Can take up to 1 day to cure (reach maximum strength)
- Upper extremities - use **8-10** layers
- Lower extremities - **12-15** layers, up to 20 if big person (increased risk of burn!)

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## Fiberglass

- Cures rapidly (20 minutes)
- Less messy
- Stronger, lighter, wicks moisture better
- Less moldable
- More expensive
- Much shorter shelf life than plaster

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## Ready Made Splinting Material

- **Plaster**
  - 10 -20 sheets of plaster with padding and cloth cover
- **Fiberglass**
  - Sheets with synthetic padding
- **Prefabricated splints and casts**
  - Plastic/metal
  - Some are very fancy (and expensive)



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### General Principles of Splint Application

**A** Stockinette applied to extend 2-3 inches beyond plaster.

**B** 2-3 layers of pad applied and smoothed.

**C** Plaster applied and stockinette rolled over plaster edge.

**D** Ace wrap applied over plaster.

**E** Plaster molded as it dries

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### Splints

**Upper Extremity**

- **Elbow/Forearm**
  - Long Arm Posterior
  - Double Sugar - Tong
- **Forearm/Wrist**
  - Volar Forearm / Cockup
  - Sugar - Tong
- **Hand/Fingers**
  - Ulnar Gutter
  - Radial Gutter
  - Thumb Spica
  - Finger Splints

**Lower Extremity**

- **Knee**
  - Knee Immobilizer / Bledsoe
  - Bulky Jones
  - Posterior Knee Splint
- **Ankle**
  - Posterior Ankle
  - Stirrup
- **Foot**
  - Hard Shoe

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### Long Arm Posterior Splint

- **Indications**
  - Elbow and forearm injuries:
  - Distal humerus fx
  - Both-bone forearm fx
  - Unstable proximal radius or ulna fx (sugar-tong better)
- Doesn't completely eliminate supination / pronation -either add an anterior splint or use a double sugar-tong if complex or unstable distal forearm fx.

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### Double Sugar Tong

- **Indications**
  - Elbow and forearm fx - prox/mid/distal radius and ulnar fx.
  - Better for most distal forearm and elbow fx because limits flex/extension and pronation / supination.

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### Forearm Volar Splint aka 'Cockup' Splint

- **Indications**
  - Soft tissue hand / wrist injuries - sprain, carpal tunnel night splints, etc
  - Most wrist fx, 2nd -5th metacarpal fx.
  - Most add a dorsal splint for increased stability - 'sandwich splint' (B).
  - Not used for distal radius or ulnar fx - can still supinate and pronate.

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### Forearm Sugar Tong

- **Indications**
  - Distal radius and ulnar fx.
- Prevents pronation / supination and immobilizes elbow.

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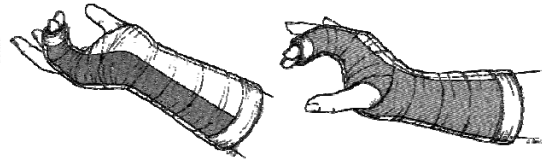
## Hand Splinting

- The correct position for most hand splints is the position of function, a.k.a. the neutral position. This is with the hand in the "beer can" position (which may have contributed to the injury in the first place) : wrist slightly extended (10-25°) with fingers flexed as shown.
- When immobilizing metacarpal neck fractures, the MCP joint should be flexed to 90°.
- Have the patient hold an ace wrap (or a beer can if available) until the splint hardens.
- For thumb fx, immobilize the thumb as if holding a wine glass.



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## Radial and Ulnar Gutter



- Indications
  - Fractures, phalangeal and metacarpal, and soft tissue injuries of the little and ring fingers.

- Indications
  - Fractures, phalangeal and metacarpal, and soft tissue injuries of index and long fingers.

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## Thumb Spica

- Indications
  - Navicular fx - seen or suspected (check snuffbox tenderness)
  - Lunate fx, lunate or perilunate disl'n.
  - All thumb fx.
  - De Quervain tenosynovitis.
- Notching the plaster (shown) prevents buckling when wrapping around thumb.
- Wine glass position.



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## Finger Splints



- Sprains - dynamic splinting (buddy taping).
- Dorsal/Volar finger splints - phalangeal fx, though gutter splints probably better for proximal fxs.

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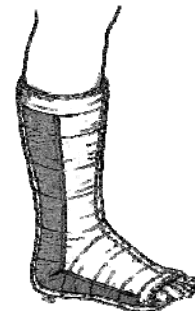
## Jones Compression Dressing - aka Bulky Jones

- Indications
    - Short term immobilization of soft tissue and ligamentous injuries to the knee or calf.
  - Allows slight flexion and extension - may add posterior knee splint to further immobilize the knee.
- Procedure:
- Stockinette and cotton roll.
  - 1-2 layers of thick cotton padding.
  - 6 inch ace wrap

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## Posterior Ankle Splint

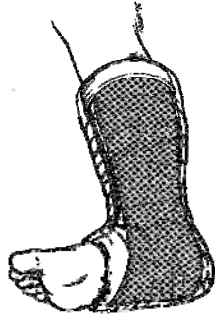
- Indications
  - Distal tibia/fibula fx.
  - Reduced dislocations
  - Severe sprains
  - Tarsal / metatarsal fx
- Use at least 12-15 layers of plaster.
- Adding a coaptation splint (stirrup) to the posterior splint eliminates inversion / eversion - especially useful for unstable fx and sprains.



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## Stirrup Splint

- Indications
  - Similar to posterior splint.
  - Less inversion /eversion and actually less plantar flexion compared to posterior splint.
  - Great for ankle sprains.
  - 12-15 layers of 4-6 inch plaster.



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## Other Orthoses

- Knee Immobilizer
  - Semirigid brace, many models
  - Fastens with Velcro
  - Worn over clothing
- Bledsoe Brace
  - Articulated knee brace
  - Amount of allowed flexion and extension can be adjusted
  - Used for ligamentous knee injuries and post-op
- AirCast/ Airsplint
  - Resembles a stirrup splint with air bladders
  - Worn inside shoe
- Hard Shoe
  - Used for foot fractures or soft tissue injuries

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## Complications

- Burns
  - Thermal injury as plaster dries
  - Hot water, Increased number of layers, extra fast-drying, poor padding - all increase risk
  - If significant pain - remove splint to cool
- Ischemia
  - Reduced risk compared to casting but still a possibility
  - Do not apply Webril and ace wraps tightly
  - Instruct to ice and elevate extremity
  - Close follow up if high risk for swelling, ischemia.
  - When in doubt, cut it off and look
  - Remember - pulses lost late.
- Pressure sores
  - Smooth Webril and plaster well
- Infection
  - Clean, debride and dress all wounds before splint application
  - Recheck if significant wound or increasing pain

**Any complaints of worsening pain -  
Take the splint off  
and look!**

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## Circumferential casts

- Short arm
- Thumb spica
- Long arm
- Short leg
- Long leg
- Cylinder

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## Casting video

- <http://www.youtube.com/watch?v=eqxwise2m8l>

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## Short arm cast



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Thumb spica cast



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Long arm cast



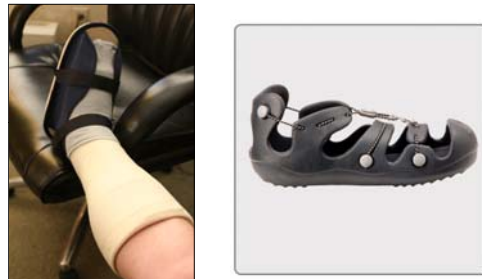
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Short leg cast



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Cast shoes



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Long leg cast



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Tools to remove casts



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## Cast removal steps

- Plan the cut lines
- Saw with in and out motion, NO linear motion
- Beware of burns – try tongue blade under line of cut
- Avoid bony prominences
- Use spreader liberally
- Cut padding and stocking with scissors
- Can use half of cast as a splint w/elastic wrap

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## Cylinder cast



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## Healing time: nonoperative fractures

Fracture	Actual Healing Time* (weeks)	Recommended Length of Immobilization† (weeks)
Proximal phalanx	4.1	4
Middle phalanx	3.7	4
Distal phalanx	4.4	3
Metacarpal (excluding fifth)	4.9	4
Fifth metacarpal (boxer's)	5.1	4
Scaphoid	7.7	6-12
Distal radius	5.6	6
Distal radius and ulna	6.7	6
Clavicle	3.9	4-6
Fibula	5.9	7-8
Metatarsal	5.9	4-6
Toes	3.6	3-4

\*Median values for time from injury to clinical healing (see reference 7).  
 †From Mercer LR: Practical Orthopedics, 3rd ed, St Louis: Mosby, 1991.

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## Patient education

- Keep cast clean
- Do not stick objects into cast
- Do not pull out the padding
- Watch for skin irritation
- Do not modify your cast
- Watch for cracking and breaking of cast

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The golden rule:

When in doubt – consult!

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