Principles of Casting

Trauma Management with Cast Application

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3 Nov 2013
Introduction

• Basic Principles of Fracture Treatment:
  • Reduce (Reduction)
  • Hold (Immobilization) → Plaster Cast
  • Exercise (Rehabilitation)
Different Types of Plaster

- Plaster Bandage: Plaster of Paris (POP)
- Resin Bandage
Plaster of Paris (POP)

- Early use in Paris area to make building plaster and cement
- Gypsum (calcium sulphate dihydrate)
- Chemical formula: amorphous anhydride calcium sulphate (CaSO$_4$.2H$_2$O)
- Dissolves in water, on drying, **exothermic reaction** to form a solid mass
- Impregnating fabric materials with gypsum to make **plaster bandage**
Synthetic Resin Bandage

Synthetic material (Fabric + resins)

- eg. **Dynacast**: glass fiber fabric + polyurethane resin
- Activation for the resin polymerization
  - Usually water
## Advantages of POP vs Synthetic Resin

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<tr>
<th>Advantages</th>
<th>POP</th>
<th>Synthetic Resin</th>
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<tbody>
<tr>
<td>Inexpensive</td>
<td></td>
<td>Shorter setting time</td>
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<td>Good molding capacity</td>
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<td>More radiolucent</td>
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<td>Long storage time</td>
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<td>Lighter</td>
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<td>Easy to handle</td>
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<td>Stronger</td>
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<td></td>
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<td>Water resistant</td>
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<td>Better ventilation</td>
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### Disadvantages

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<th>POP</th>
<th>Synthetic Resin</th>
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<tbody>
<tr>
<td>Disadvantages</td>
<td>Weaker than synthetic material</td>
<td>Less molding capacity</td>
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<tr>
<td></td>
<td>Heavy</td>
<td>Expensive</td>
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<tr>
<td></td>
<td>Non-water resistance</td>
<td>Adheres to clothing</td>
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<td></td>
<td>Radiolucency fair</td>
<td>Sticky when applying</td>
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Choice of Material

Ideal Bandage -

easily applicable, able to set rapidly, and conforming to the injured limb

Use appropriate size bandage in different region-
4” hand & forearm, 6” leg, 8” thigh

- Molding
- Weight Bearing
- Weight
- Radiolucency

- Resin Bandage is not a superior material
CR + POP

• What does it mean?
Principles Behinds “CR + POP”

• Manipulation of the fracture to improve the position of the fragments
• Should not be delayed
  • Swelling of the soft part during the first 12 hours makes reduction increasingly difficult
• Under appropriate anaesthesia / muscle relaxation / sedation / intra-haematoma block
• Manoeuvre:
  • Traction: distal part of the limb is pulled in line of the bone
  • As the fragments disengaged, they are repositioned (by reversing the original direction of force)
  • Alignment is adjusted in each plane
• Immobilization with “3-points fixation” Casting
Soft Tissue Hinge

Interlocking

Increasing the initial deformity ➔ release the interlocking without excessive traction

Fragments repositioned by reversing the deforming force

Reduction maintained by the soft tissue hinge (ligamentotaxis)
Molding ➔ 3 Points Fixation:

• A third force to neutralise the couple and the system becomes stable
• It takes a curved cast to produce a straight bone
Basic Steps for Plaster Application

- Reduction of fracture
- Padding
  - Tubegauze / stockinette
  - Velban application
- Plaster application
- Molding
- Trimming & reinforcement
- Removal
Closed Reduction of Colles’ Fracture

Continuous traction with counter-traction

Dis-impaction & Manipulation

Reduce dorsal angulation: wrist flexion 20° to 30°

Correct radial deviation: wrist ulnar derivation 10°
Extending to the joint above & longer than the limb for easy handling of the extremity
Padding – Velban

- Smooth and even
- Overlapping 50%
- Thin layer is enough, otherwise would affect the fit & holding ability of the cast
- Thicker at bony prominences
- Control swelling
Plaster Bandage Activation

- Lifted with dry hands
- Thorough immersion in water at room temperature
- Water gently squeezed out until no more bubbles
- Remove from water and further squeeze out excessive water

at 30° angle to allow air bubbles to escape

Roll out 10-20cm POP bandage before
- Smoothly and evenly applied
- Continuous folds to cover at least half of previous fold
- Smooth out every layer to remove air
- Figure of 8 when crossing joint, prevent in-folding of plaster causing sore
Plaster Application

- Cutting out or out-folding the angles of POP slab to avoid pressure point at corner

- Stockinette fold back at the end to make the edge smooth
Molding

- To fit external anatomy of the limb & create 3-point fixation
- Start during application
- Continuous & Dynamic
- Use palms and thenar eminences (NOT fingers)
What are they doing?

A) 3-point fixation for better stability
B) Better contouring of the cast
C) Facilitate rehabilitation
D) All of the above
Molding

Excluding the 5th finger from the grip to allow the ample accommodation for the transverse palmar arch.

Oblong shape to maintain palmer arch.

3-point fixation for distal radius fracture.
Trimming

- Allow unobstructed motion for joints not needed to be immobilized
- Prevent impingement sore
- For short arm POP for distal radius #: POP extends from knuckles & palmer crease to below elbow ➔ check free motion of elbow, thumb, little finger, & MCPJs
Check Before Trim
Trimming
Reinforcement

- Adding slab
- Hybrid casting: POP for better molding inside, synthetic cast outside for strength & reduced weight
- Ridging
For Wound Inspection

- Making a hump with thick gauze over the wound site for opening of window
- Cut out the hump after POP set
Other Types of Casting

¾ Slab for distal radius

U-slab for humerus

Sarmiento cast for tibia
Cast Removal

- Initial bivalving at diametrically opposite points on the circumference
- Cutting should not pass bony prominence
- Oscillating electric plaster saw or plaster shears
- Spreader, bender

- Immerse POP in water, peel out after softened
Basic Equipment
Electric Saw

- vibrates at low amplitude
- cuts off stiff material but not skin
- only used on dry and padded plaster
- stepping without dragging
- the blade can become very hot
Electric Saw
Spreader
Always split on the concave side.
Plaster Shears
Complications of Plastering

- Circulatory disturbance
- Nerves compression
- Pressure sore
- Edema swelling
- Allergy
- Deep burn
- Saw injury or heat burn on removal
- Joint stiffness after prolonged immobilization
Poor Manipulation & Reduction

- Insufficient relaxation
- Inadequate reduction
- Poor understanding of fracture mechanics
- Fail to lock # after reduction
Pitfalls in Plastering

Poor plaster technique will end up with:

- Too tight ➔ Neurovascular compromise / compartment syndrome
- Excessive padding / Edema subsided ➔ loosening
- Poor application across joint ➔ joint buckling
- Lamination of plaster ➔ air trapped weaken the cast
- Poor molding ➔ failed immobilization / impingement
- Poor trimming ➔ sharp edges / impingement sore
What problem?

A. Poor molding causing impingement
B. Cast too thick
C. Dynacast should be used
D. All of the above
Poor Molding
What problem?
Poor Handling

Don’t leave your signature on the cast
What problem?
Buckling
How to detect pressure sore inside a cast?

A. Burning sensation
B. Offensive smell
C. Fluid stained plaster
D. All of the above
Clues of Plaster Sore

- Itching & burning sensation
- Fever, sleep disturbance & fretfulness
- An area of local heat on the plaster
- Offensive smell or discharge
- Fluid-stained plaster
Prevention of Pressure Sore

- Good padding
- Proper application of plaster esp over bony prominence & crossing joint
- Out-folding of POP slab to avoid pressure point at corner
- Smooth molding
- Trimming
Plaster Burn

- Heat generated during the setting can cause burn, especially if patient is unconscious who cannot C/O hot to you!
- Lower limb long leg POP ➔ need more layers for strength ➔ more exothermic reaction
- Suggest to use prefabricated splint or synthetic cast for LL
Follow Up Care

- Frequency & timing
- Check POP fitness
- Detect complications
Case 1: What is the first thing to do?

A. CR + POP
B. Book OT for ORIF
C. Remove the ring
D. Find relative for consent for sedation
Case 2: What happen & What to do?

Distal swelling

A. UL Elevation
B. Finger mobilization
C. Loosening the plaster
D. All are correct
Case 3: What happen & What to do?

16 hrs after POP, develop finger numbness and pain

Compartment Syndrome

1. Split all layers of cast, down to skin, throughout the whole length of cast
2. Emergency fasciotomy if clinical suspicious
Incomplete Slab – for Acute Cases with Gross Swelling

- Use ¾ Dorsal Slab rather than complete casting for initial treatment of distal radial fracture to prevent over tightening of cast
- Reduce the risk of distal edema / compartment syndrome
Always Remember the Basis & Precautions to Make a Good Cast
The End
Thank You