

ORTHOPAEDICS



FOR PRIMARY
HEALTH CARE



LION

LEARNING INNOVATION VIA
ORTHOPAEDIC NETWORKS

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Plaster of Paris casts

by Nicholas Kruger & Pieter Venter

Learning objectives

1. Know the different clinical applications of plaster of Paris.
2. Know the steps in the application of a plaster of Paris cast.
3. Understand what the basic set of upper and lower limb casts are and when to apply them.
4. Describe the different braces used in orthopaedic surgery.

Introduction

The correct application of plaster of Paris (POP) is a necessary skill for any clinician. It still has a definite place in managing orthopaedic injuries, even in the age of modern surgical advances.

It is widely used pre-operatively for temporary immobilisation and stabilisation of fractures, post-operatively for protection of fixation and soft tissue resting, correcting deformities and definitive management of specific injuries.

The origin of the name plaster of Paris is because the quarries from which it was mined were near Paris in France.

When POP is mixed with water, the more soluble calcium sulphate returns to its insoluble form, giving off heat and cool to cold water should be used for the mixture to limit the chance of thermal injury.

After application and moulding, it is imperative to maintain the position you wish to obtain for three to five minutes, which is how long the POP will take to set initially after wetting. After that, the plaster will ultimately harden after 36 – 48 hours.

Skill: Plaster of Paris application

Setup

Preparation is crucial. Gather all the necessary components together (number of rolls of POP, water, cotton padding, OrthoWool™ and so on) before starting the procedure.

Note: all wounds need to be adequately dressed/covered before application of a cast.



Step 1: Examination

Do an examination of the limb to be splinted.

- Neurovascular examination.
- Quality of skin in the area where the plaster will be applied (for example, wounds, blisters, bruising).
- Ensure that radiographs of the limb (plus the joints above and below) have been reviewed.



Step 2: Positioning

The patient and the person applying the plaster should both be comfortably positioned for the procedure.

The limb that is to be placed in the cast should be held in the correct position.

Specific casts need more than one set of hands, so get an assistant to help.

Step 3: Stockinette

If available, use Stockinette to cover the skin of the affected limb, 3–4 cm longer at the ends so it can be folded back under the POP.



Step 4: Cotton wool padding

Starting distally, wrap the padding proximally and overlap each layer by 50%.

Apply additional padding over areas with bony prominences.

Use a 'figure of 8' technique around joints to prevent wrinkling and unnecessary compression (for example, around the elbow to prevent cubital fossa pressure).



Step 5: Plaster application

Ensure that the limb is in the correct position for applying the cast.

Soak the plaster roll in the bucket of water until bubbles cease to rise, remove from the water and gently squeeze the excess water from the roll, without drying it thoroughly.

Apply the POP on top of the cotton wool padding from distal to proximal, without applying tension to the roll, overlapping each layer by 50%. Use the 'figure of 8' technique around joints and prevent wrinkling of the plaster by smoothing the layers down with your palm. Ensure immobilisation of the joints above and below the injury. A slab splint (back slab) is usually applied and secured with a cling bandage to allow for swelling in the acute setting.



Step 6: Moulding the plaster

The cast must be moulded around the limb, without causing soft tissue injury to ensure adequate immobilisation and stability. When using casts to splint fractures, a three-point pressure technique must be used (one pressure point countering the apex of the fracture, one distally and one proximally on the opposite side of the fracture apex).

During this step, the limb must be correctly positioned, and the position maintained for three to five minutes for the cast to set. Also ensure that the edges are smoothed out and will not irritate nearby structures (for example, the thumb base in a forearm cast).



Step 7: Clean the limb

Clean exposed areas of skin with water and dry with paper towels.



Step 8: Repeat examination

Repeat a neurovascular examination and inspect that the cast does not hinder any movements other than those needed for injury management.

Step 9: Radiography

Repeat radiographs if any manipulation was done and to confirm the correct position of the underlying bone.

Step 10: Patient education

Counsel your patient:

- On why the cast was applied, when they should follow up and for how long they can expect the cast to stay on.
- Do not put anything down the cast to scratch; the skin might be injured and get infected.
- Do not let the cast get wet.
- Frequently move the fingers or toes of the immobilised limb.
- Elevate the casted limb to prevent swelling.

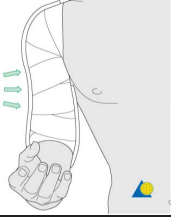
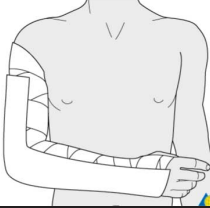
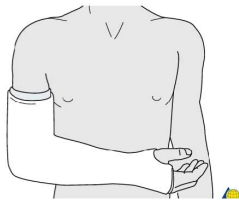
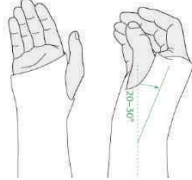

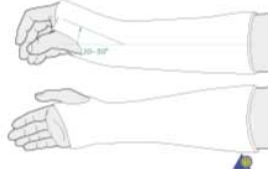
Also, counsel them on when to seek immediate medical attention:

- Increased pain and swelling.
- Numbness or increasing pressure in the casted limb.
- Unusual smell of any drainage.
- Colour change of the digits distal to the cast.
- The cast breaks or comes off.

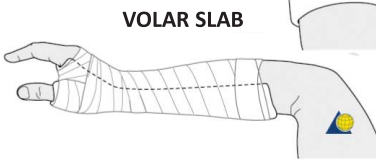
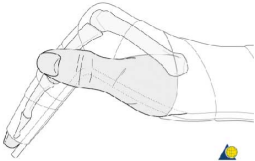
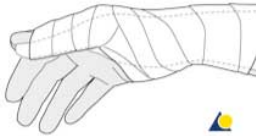

How to remove a cast safely

- Using an oscillating electric POP cast saw, make two longitudinal cuts along opposing surfaces of the cast, avoiding areas where the bone is prominent.
- The saw cut is progressed by 'dabbing' it along, not sliding, as this may scratch the skin.
- Once the vertical cuts have been made, loosen the cast with a plaster spreader.
- Complete the division of the plaster and the padding with plaster scissors, with careful attention not to injure the underlying skin.
- The saw is noisy and may scare patients, especially children. Reassure them by demonstrating the saw on your palm before applying the POP.

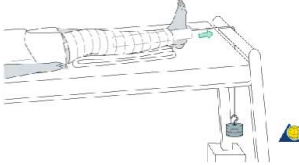
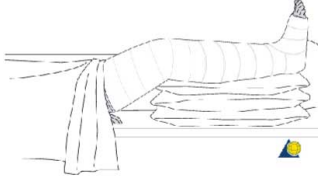
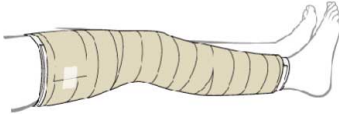
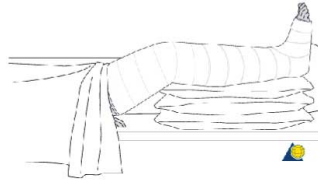

PLASTER APPLICATION: UPPER LIMB

AREA AFFECTED	SITE	MANAGEMENT	COMMENTS
HUMERUS	PROXIMAL	SHOULDER IMMOBILISER (SLING)	
	SHAFT	U-SLAB 	FROM AC JOINT, AROUND ELBOW, INTO AXILLA (ELBOW IN 90° FLEXION) COLLAR & CUFF 6 x 150mm POPs
	DISTAL (INCLUDING ELBOW)	ABOVE ELBOW BACKSLAB 	FROM PROXIMAL ARM TO 1 ST PALMAR CREASE (ELBOW IN 90° FLEXION) 4 x 150mm POPs
RADIUS & ULNA	SHAFT	PRELIMINARY: ABOVE ELBOW BACKSLAB UNDISPLACED ULNA/RADIAL HEAD (ALL RADIUS SHAFT #'s NEED ORIF): ABOVE ELBOW CIRCULAR CAST 	ABOVE ELBOW BACKSLAB (AS ABOVE) ABOVE ELBOW CIRCULAR CAST: FROM PROXIMAL ARM TO 1 ST PALMAR CREASE (INCORPORATE WRIST) 
	DISTAL (RADIUS)	PRELIMINARY: 'SUGAR TONG' SPLINT  FROM 1 ST PALMAR CREASE AROUND ELBOW OVER DORSUM OF HAND 4 x 150mm POPs	DEFINITIVE: BELOW ELBOW CIRCULAR POP  FROM 1 ST PALMAR CREASE TO PROX 1/3 OF FOREARM 3 x 100mm POPs

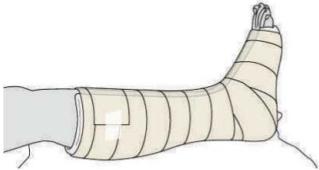
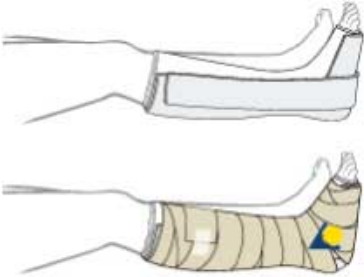
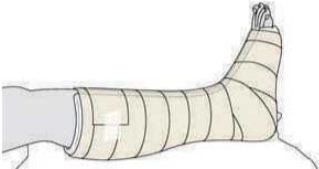

PLASTER APPLICATION: UPPER LIMB

AREA AFFECTED	SITE	MANAGEMENT	COMMENTS
HAND	CARPALS	VOLAR SLAB 	VOLAR SLAB FROM 1 ST PALMAR CREASE TO PROX 1/3 OF FOREARM 3 x 100mm POPs
	METACARPALS & PHALANGES	Z-SPLINT 	FUNCTIONAL POSITION OF WRIST (30°) & MCPJs (90°) FROM DISTAL PHALANX TO MID-FOREARM 3 x 100mm POPs
	THUMB	PRELIMINARY: THUMB SPICA SLAB  DEFINITIVE: THUMB SPICA POP 	FROM DISTAL PHALANX (MUST IMMOBILISE INTERPHALANGEAL JOINT) TO MID-FOREARM 2 x 50mm POP FOR THUMB 3 x 100mm POPs FOR FOREARM

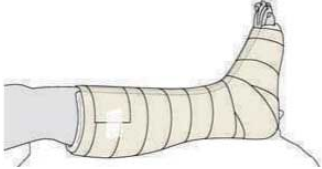


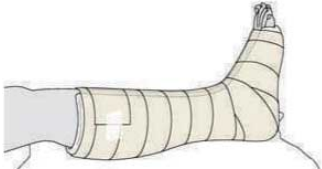
PLASTER APPLICATION: LOWER LIMB

AREA AFFECTED	SITE	MANAGEMENT	COMMENTS
FEMUR	NECK OF FEMUR/ INTERTROCHANTERIC REGION	PRELIMINARY SKIN TRACTION 	WEIGHT APPLIED TO TRACTION SHOULD BE 10% OF BODY WEIGHT (UP TO MAX. OF 4.5kg) <i>NB: MOST WILL REQUIRE ORIF</i> FEMUR SHAFT FRACTURES REQUIRE THOMAS SPLINT
	SHAFT		
	DISTAL	ABOVE KNEE BACKSLAB 	FROM PROXIMAL THIGH (GLUTEAL FOLD) (KNEE IN 20-30° FLEXION) 8 x 150mm POPs
PATELLA		ABOVE KNEE BACKSLAB (ANKLE SPARING) 	FROM PROXIMAL THIGH (GLUTEAL FOLD) TO ABOVE MALLEOLI (FULL EXTENSION) 8 x 150mm POPs
TIBIA	PROXIMAL (INCL. PLATEAU)	PRELIMINARY: ABOVE KNEE BACKSLAB (ANKLE INCLUDED) 	ABOVE KNEE BACKSLAB: FROM PROXIMAL THIGH (GLUTEAL FOLD) TO MTPJ (KNEE IN 20-30° FLEXION, ANKLE IN 90° DORSIFLEXION) 9-10 x 150mm POPs
	SHAFT	DEFINITIVE: ABOVE KNEE CIRCULAR CAST (SHAFT ONLY) 	ABOVE KNEE CIRCULAR CAST: FROM PROXIMAL THIGH (GLUTEAL FOLD) TO MTPJ (KNEE IN 20-30° FLEXION, ANKLE IN 90° DORSIFLEXION) 12 x 150mm POPs

PLASTER APPLICATION: LOWER LIMB

AREA AFFECTED	SITE	MANAGEMENT	COMMENTS
TIBIA	DISTAL (PLAFOND/PILON)	<p>BELOW KNEE BACKSLAB:</p> 	<p>FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p>
MALLEOLI (ANKLE)	TALAR SHIFT PRESENT	<p>BELOW KNEE BACKSLAB WITH MALLEOLAR U-SLAB:</p> 	<p>BELOW KNEE BACKSLAB:</p> <p>FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p> <p>MALLEOLAR U-SLAB:</p> <p>FROM MID-LOWER LEG & LOOP AROUND HEEL TO COVER MEDIAL & LATERAL MALLEOLI.</p> <p>3 X 100MM POPs</p> <p><i>NB: REDUCE TALAR SHIFT WITH MEDIAL PRESSURE WHEN PLASTER IS STILL WET</i></p>
	TALAR SHIFT ABSENT	<p>PRELIMINARY: BELOW KNEE BACKSLAB</p>  <p>DEFINITIVE: BELOW KNEE CIRCULAR CAST</p> 	<p>BELOW KNEE BACKSLAB:</p> <p>FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p> <p>BELOW KNEE CIRCULAR CAST:</p> <p>FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p> <p><i>NB: CONSERVATIVE Rx IN CAST ONLY INDICATED FOR UNDISPLACED LATERAL MALLEOLI FRACTURES WITH NO MEDIAL TENDERNESS & NO TALAR SHIFT</i></p> <p>IF SWELLING ALLOWS</p>

PLASTER APPLICATION: LOWER LIMB

AREA AFFECTED	SITE	MANAGEMENT	COMMENTS
FOOT	TARSALS METATARSALS	<p>PRELIMINARY: BELOW KNEE BACKSLAB</p>  <p>DEFINITIVE: BELOW KNEE CIRCULAR CAST</p> 	<p>BELOW KNEE BACKSLAB: FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p> <p>BELOW KNEE CIRCULAR CAST: FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p> <p>IF SWELLING ALLOWS</p>
	PHALANGES	<p>'BUDDY STRAPPING' & BELOW KNEE BACKSLAB</p>  	<p>'BUDDY STRAPPING': USING 2 x 5-10mm PIECES OF ELASTOPLAST, TAPE AFFECTED TOE TO ADJACENT TOE</p> <p>BELOW KNEE BACKSLAB: FROM JUST BELOW KNEE (ABOVE FIBULA NECK) TO MTPJ ANKLE IN 90° DORSIFLEXION</p> <p>5 x 150mm POPs</p>

Plaster application images © AO Foundation, Switzerland

Source: AO Foundation Online Surgery Reference (www.aofoundation.org)

Access Emergency Medicine (www.accessemergencymedicinemhmedical.com)

Essential takeaways

- Proper application of a plaster cast is an invaluable skill that is still widely used in orthopaedics.
- Be aware of the setting times of POP to maintain the intended position.
- Patient education regarding POP care and danger signs.

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ABOUT THE BOOK

Informed by experts: Most patients with orthopaedic pathology in low to middle-income countries are treated by non-specialists. This book was based on a modified Delphi consensus study* with experts from Africa, Europe, and North America to provide guidance to these health care workers. Knowledge topics, skills, and cases concerning orthopaedic trauma and infection were prioritised. Acute primary care for fractures and dislocations ranked high.

Furthermore, the diagnosis and the treatment of conditions not requiring specialist referral were prioritised.

* Held et al. Topics, Skills, and Cases for an Undergraduate Musculoskeletal Curriculum in Southern Africa: A Consensus from Local and International Experts. JBJS. 2020 Feb 5;102(3):e10.

THE LION

The Learning Innovation via Orthopaedic Network (LION) aims to improve learning and teaching in orthopaedics in Southern Africa and around the world. These authors have contributed the individual chapters and are mostly orthopaedic surgeons and trainees in Southern Africa who have experience with local orthopaedic pathology and treatment modalities but also in medical education of undergraduate students and primary care physicians. To centre this book around our students, iterative rounds of revising and updating the individual chapters are ongoing, to eliminate expert blind spots and create transformation of knowledge.

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The information in this book is meant to supplement, not replace, Orthopaedic primary care training. The authors, editor and publisher advise readers to take full responsibility for their safety and know their limits. Before practicing the skills described in this book, be sure that your equipment is well maintained, and do not take risks beyond your level of experience, aptitude, training, and comfort level.

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