

# **POR4ULO**

## **Assessment**

Low temperature thermoplastic  
orthoses for the Hand / Digit

Practical Guide

## Pattern Making for Upper Limb, Low Temperature Thermoplastic Orthoses

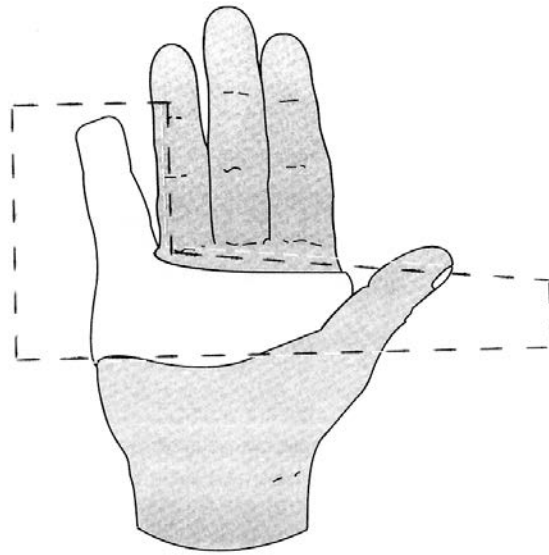
The use of low temperature thermoplastics for upper limb orthotic treatments is more common than for any other body region, particularly for treatment of wrist and hand pathologies. The reasons for the use of these materials are varied but mostly relate to the fact the upper limb is not a weightbearing structure (compared to the lower limb) and the body segments are generally not as large as other segments of the body. For these reasons low temperature thermoplastics provide sufficient strength and durability for short-term applications. The upper limb is also commonly subjected to trauma (more than other body segments) and the high rate of fractures and other traumatic injuries necessitate the requirement for immediate, short-term treatment solutions.

The following information serves as a guide to pattern making and design of low temperature thermoplastic orthoses for the upper limb. Variations on these designs are possible and may be necessary depending on the individual patient and his/her pathology.

Low temperature thermoplastics can vary according to the individual properties of the plastic, however most products have some or all of the following properties:

- Perforated or non-perforated sheets available
- Typical sheet thickness can vary from 1.6mm – 10mm
- Material may have a coating (e.g. cloth)
- Material can be heated using very hot or boiling water (70-100 degrees) or dry heat (oven or heat gun with maximum heat 150 degrees)
- Most materials will self bond when heated (better with dry heat) and some will ‘snap’ back open when cooled
- Material heats and becomes mouldable rapidly (a few minutes) and has a working time of approx. 5-10 minutes (depending on method of heating, thickness, room temperature etc)
- Material can be trimmed with scissors when heated and will often form a smooth rounded edge when cut at this stage
- Material can be stretched to conform to anatomy and self bonded to provide circumferential mould
- Material can be wrapped onto limb using elastic bandages
- Material can be locally modified (using heat gun or very hot water)
- Material can be ground and buffed generally at low speed and using low pressure to minimise melting of plastic and ‘clogging up’ of sanding drum or buffing wheel
- Self adhesive Velcro and rivets can be applied to material
- Contact adhesives can be used to add linings etc if surface is ‘scratched’

## PIP Extension Orthosis (digits 2 or 5)

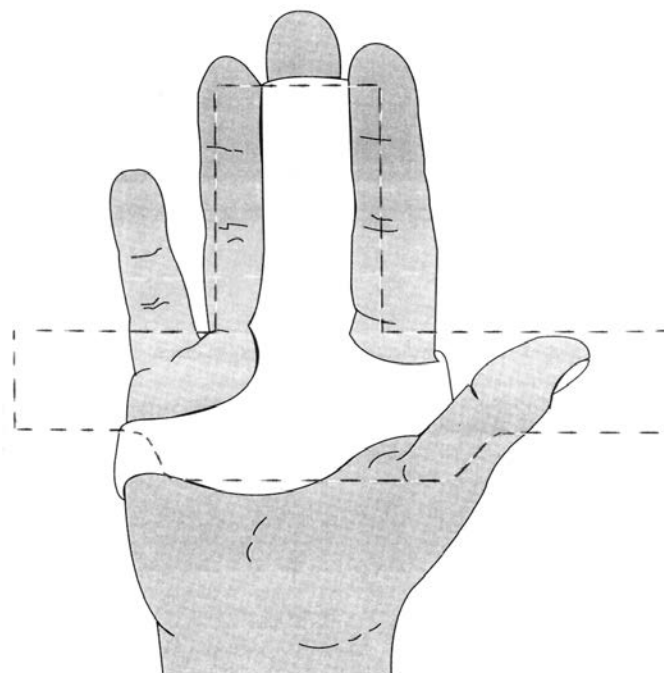


### Example Indications:

- Fractures of middle phalanx
- Contractures
- Ruptured extensor tendon

**Procedure:** Cut a wide 'L' shape where the short side is twice the finger length and the width is equal to the finger circumference plus 1cm. The long part of the 'L' needs to be sufficiently long to wrap onto the dorsum of the hand. Mould and create a dorsal weld along the 2<sup>nd</sup> or 5<sup>th</sup> finger. Use a single Velcro strap to secure across the dorsal hand. If IP joints are prominent a dorsal opening may be required along the finger with a Velcro strap to allow donning and doffing.

## PIP Extension Orthosis (digits 3 or 4):

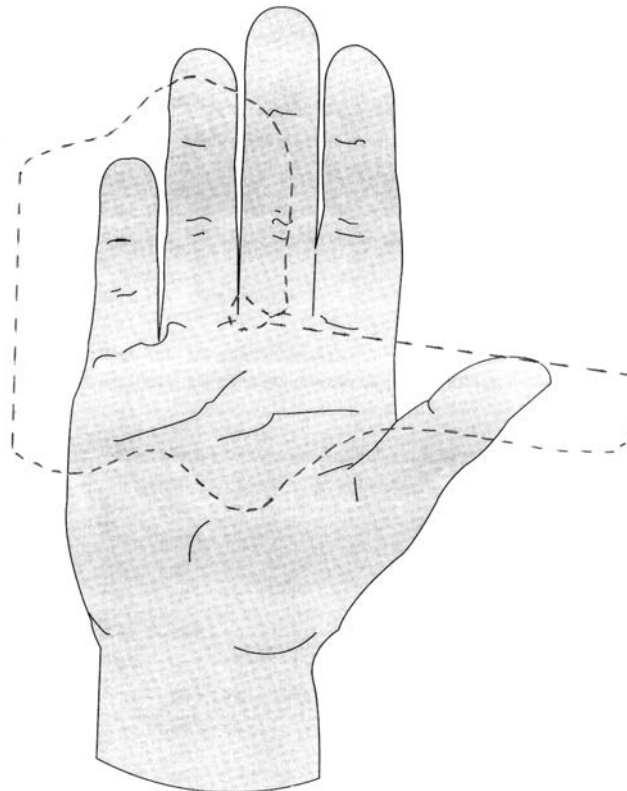


**Example indications:**

As per above

**Procedure:** Cut a wide ‘T’ shape where the stem of the ‘T’ is approximately 1.5 times the length of the finger and the width is equal to the finger circumference plus 1cm. The bar of the ‘T’ must be sufficiently long to wrap onto the dorsum of the hand on both the medial and lateral sides. Mould and create a dorsal weld along the 3<sup>rd</sup> or 4<sup>th</sup> finger. Use a single Velcro strap to secure across the dorsal hand. If IP joints are prominent a dorsal opening may be required along the finger with a Velcro strap to allow donning and doffing.

**PIP Extension Orthosis (digits 4 & 5):**

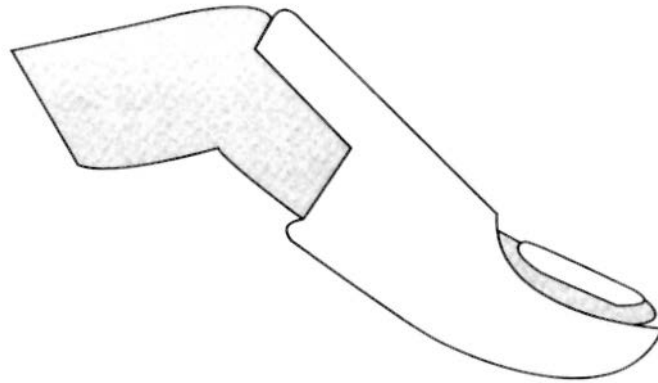


**Example Indications:**

As per above where both the 4<sup>th</sup> and 5<sup>th</sup> finger are involved or where the support of another the adjacent finger will provide additional stability.

**Procedure:** Cut a pattern as shown above where the finger section is approximately 1.5 times the length of the fingers and the width is equal to the fingers’ circumference plus 1cm. The palm section must be sufficient in length to wrap onto the dorsum of the hand. Mould and create a dorsal weld along the 4<sup>th</sup> and 5<sup>th</sup> finger. Use a single Velcro strap to secure across the dorsal hand. If IP joints are prominent a dorsal opening may be required along the fingers with a Velcro strap to allow donning and doffing.

## DIP Extension Orthosis (digits 1-5):

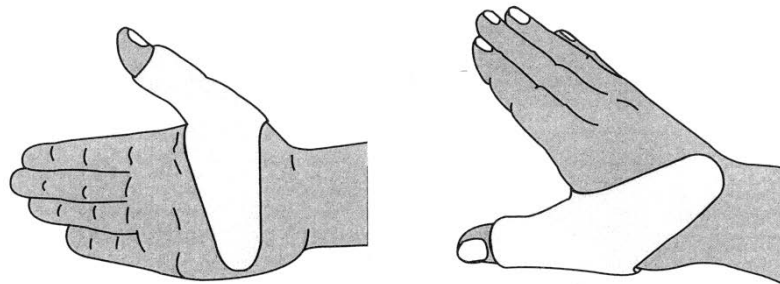
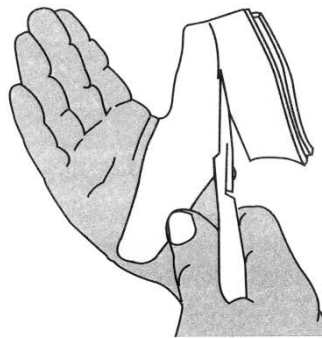
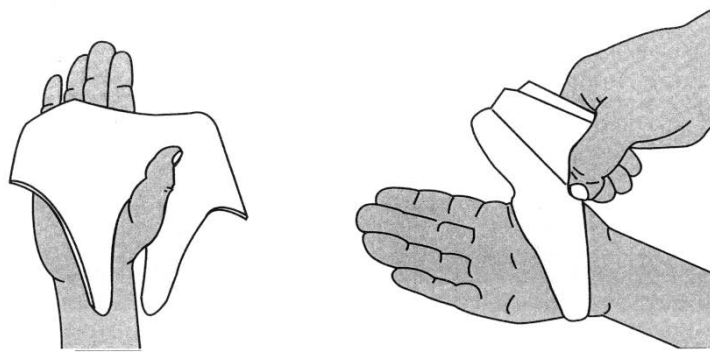
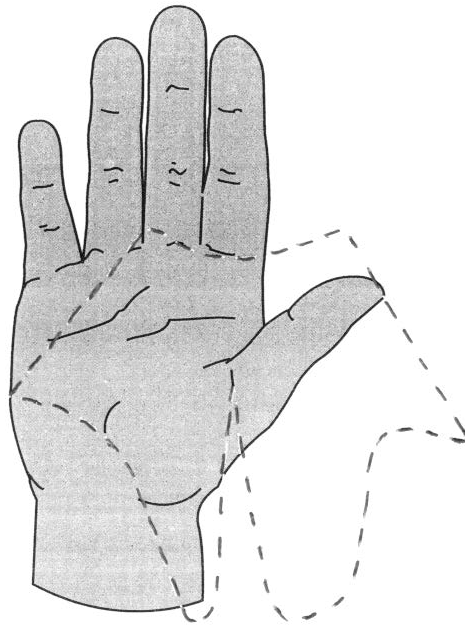


### Example Indications:

- Mallet finger injury (rupture of the extensor tendon)
- DIP flexion contractures

**Procedure:** Cut a rectangular shape slightly longer than the length of the finger from the distal tip to the PIP joint and approximately the circumference of the finger. Place a small hole in the centre of the piece using a hole punch or drill. Mould by sliding the piece onto the finger placing the finger through the central hole and mould the proximal plastic down on the dorsum of the finger between the PIP and DIP joints (as shown above) and the distal plastic up on the palmar aspect of the finger between the DIP joint and the tip of the finger. Hold in a hyperextended position until cool. Use a single Velcro circumferential strap to secure at the proximal end.

### Thumb 'Spica':



**Example Indications:**

- 1<sup>st</sup> MCP joint OA
- Proximal phalanx fracture
- Ulnar collateral ligament injury (Gamekeepers thumb)

**Procedure:** Cut a shape as shown above with the distal ‘wings’ extending from the MCP joint to a few centimeters proximal to the wrist crease. The medial and lateral proximal section of the pattern must be adequately wide and long to enclose the length of the thumb from proximal to the MCP joint to distal to the PIP joint. Position the thumb in opposition with the index finger (or alternative position depending on the pathology) and mould as shown above creating a dorsal weld along the thumb. Use a single Velcro strap to secure the proximal ‘wings’. If IP joint is prominent a dorsal opening may be required along the thumb with a Velcro strap to allow donning and doffing.

Alternatively if greater proximal security is required (i.e. to include more of the MCP, CMC and wrist joints) then a simple rectangular shape can be created as long as desired to cover the required joints, and the width of the plastic should be wide enough to provide ML stability (may cover entire radial side of wrist and hand to the midline of the hand and forearm – more or less as required). Mould by wrapping over the radial side of the wrist and creating a weld in the thumb web space. Use a Velcro strap(s) to secure circumferentially around the hand and or forearm/wrist. If IP joint is prominent an opening may be required along the thumb web space with a Velcro strap to allow donning and doffing.