# Hand orthoses: clinical reasoning throughout the care pathway

Educational article - English edition

Grégory Mesplié - ASHT International Guest for 2025 - Salt Lake City

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**This article is based on the presentation delivered by Grégory Mesplié in Salt Lake City as ASHT's International Guest for 2025. Only one International Guest is selected each year.** Grégory Mesplié, physiotherapist, CHT. Presentation title: *Splinting throughout the care pathway: Between clinical reasoning and practical knowledge*.

**A hand orthosis is selected to address a specific clinical problem.** The same loss of range of motion may reflect capsular contracture, tendon adhesions, motor impairment or a bony block. These situations require different mechanical actions. The Salt Lake presentation connects hand assessment, orthosis fabrication and ongoing adjustment throughout recovery.

The aim is to protect healing tissues, preserve permitted movement and restore useful hand function. This reasoning goes beyond selecting a material or reproducing a pattern.

## 1. Define what the orthosis needs to achieve

The presentation distinguishes non-articular orthoses, such as some buddy-strapping arrangements, from orthoses acting on one or more joints. Buddy strapping may limit lateral stresses while allowing some flexion and extension. Its indication depends on injury stability and assessment of digital alignment.

Joint orthoses can immobilise a segment, restrict a range of motion, apply a mobilisation force or redirect muscular forces. A functional orthosis helps a person perform an activity despite a persistent impairment. The device's name becomes useful when it describes the intended action.

The prescription should therefore specify the structure to protect or mobilise, the direction of loading and the joints that must remain free. A photograph of the device is not sufficient to establish its indication.

## 2. Protect without immobilising more than necessary

After injury or surgery, an orthosis must respect the stability achieved and the strength of healing tissues. Joints whose movement does not compromise this protection may participate early in rehabilitation, in accordance with the instructions specific to the injury and repair.

Fabrication is thus the start of follow-up: checking contact areas, explaining application, defining permitted movements and arranging reassessment. Reduced swelling can rapidly change fit and pressure distribution. The presentation describes initial immobilisation followed by an adapted orthosis as hand volume changes. Timing remains individualised.

Reducing remoulding and waste is a relevant objective. Any reuse of a device nevertheless requires a material and reprocessing procedure validated for that purpose.

# 3. Distinguish active from passive limitation

**Relatively preserved passive motion with an active deficit** points towards a problem with movement production or transmission: motor control, nerve injury, muscle insufficiency, tendon continuity or gliding. An active-passive discrepancy does not, by itself, identify an adhesion. Pain and apprehension may also limit effort.

**Limitation of both active and passive motion** suggests resistance to movement. Assessment investigates capsuloligamentous contracture, musculotendinous or cutaneous involvement, a painful response, or an articular or bony block. Increasing a positioning force does not resolve a mechanical block. Suspected rupture, instability or structural impingement requires appropriate reassessment.

Measurements must specify the movement tested and the position of adjacent joints. Repeating them under comparable conditions helps distinguish reproducible change from variation caused by testing.

# 4. Test the influence of adjacent joints

The position-dependent nature of a limitation is a central point in the presentation. When a digital deficit varies with wrist or other joint position, the examiner investigates the involvement of a structure crossing several segments.

The example given is finger extension that becomes more available with wrist flexion and more restricted with wrist extension. This behaviour may suggest involvement of the extrinsic flexors and their gliding. It does not, on its own, prove adhesion to fixation hardware.

Conversely, a deficit that changes little with adjacent joint position may suggest a more local component. These tests provide findings to interpret alongside the whole examination. The orthosis must then control the segments required for the intended effect, avoiding transfer of stress to healthy joints.

# 5. Choose a mobilisation approach

**A serial static orthosis** holds a mobilisation position and is remoulded as mobility and tolerance change. Its effectiveness depends in particular on moulding quality and monitoring of contact areas.

**A dynamic orthosis** applies an elastic force. The line of pull, lever arms and counterforces determine the moment transmitted to the joint. Two devices using the same elastic band can therefore produce very different stresses.

**A static progressive orthosis** uses an adjustable, non-elastic system. Adjustment follows changes in resistance, within the limits of tissue tolerance.

A randomised comparative study by Glasgow and Ballard allocated 61 participants to these three types of PIP extension orthosis. Fifty had follow-up data at four weeks. Active extension deficit improved by approximately 9° on average, with no statistically significant between-group difference. These findings do not establish one type as consistently superior. Selection remains linked to the clinical situation,

comfort and actual use. [1]

# 6. Use active redirection of forces

An active force-redirection orthosis changes the conditions under which muscles act, directing their effect towards the target joints. Selective immobilisation of a proximal segment may facilitate movement of a distal segment. The patient then provides the driving force for mobilisation.

The presentation illustrates this principle through relative motion orthoses (RMO) and *Casting Motion to Mobilize Stiffness* (CMMS). In the examples shown, relative metacarpophalangeal position changes the balance of forces contributing to interphalangeal flexion or extension.

“Yoke” is a historical label. Here we prefer RMO, specifying RME (relative motion extension) or RMF (relative motion flexion) according to the involved MCP joint’s position relative to its neighbours, rather than the injured tendon. [6]

Colditz describes using plaster to selectively immobilise certain joints and recruit available active movement. This provides a technical and clinical framework. It is not comparative evidence that CMMS is superior for every stiff hand. [2]

# 7. Dose loading according to tissue response

Orthotic dose results from force magnitude, direction, contact area and duration of application. Local stress also depends on device geometry. A modest force concentrated over a small area may be poorly tolerated.

The experimental mechanobiology studies cited in the presentation support the value of appropriate mechanical stimulation. Translation to an injured hand remains limited: a cellular model cannot directly determine orthosis tension or wearing time for a patient.

Adjustment is therefore based on examination and the response during wear, after removal and between sessions. A sustained increase in pain, swelling, paraesthesia or skin damage calls for review of the device and dose. A gain measured immediately after positioning does not, by itself, demonstrate lasting remodelling. Nor does pain identify a supposed “elastic failure zone”.

# 8. Understand TERT and the limits of a universal timetable

*Total End Range Time* (TERT) is the cumulative time a joint is held under tension at its available end range. It describes effective mechanical exposure. The time for which the device is simply worn may differ.

In the trial by Punsola-Izard and colleagues, 57 fingers with PIP flexion contracture were allocated to two daily mobilisation durations using an elastic neoprene digital orthosis. At three weeks, mean passive extension improvement was 29° in the higher-dose group versus 19° in the other group. These findings concern this device, population and movement. They do not validate 20-24 hours of wear for every contracture. [3]

The “6 hours” and “24 hours” landmarks in the slides serve to discuss adapting exposure as tissues evolve. Healing remains a continuum, varying with the structure, injury, treatment and reactivity. These

landmarks must be translated into an individualised prescription and reassessed.

The direction of mobilisation also matters. Flexion devices may create pressure and circulatory stresses that limit prolonged tolerance. The 15-25-minute sequences mentioned in the presentation are practice examples to adapt to the device and clinical response. Guided active movement may address some of these difficulties without requiring continuous passive positioning.

# 9. Integrate motor control and education

Immobilisation also affects the hand's sensorimotor experience. Roll and colleagues studied 16 healthy volunteers immobilised for five days. Their brain imaging findings suggest that proprioceptive and tactile stimulation inducing a perception of movement may preserve certain sensorimotor networks. This mechanistic study does not demonstrate universal clinical effectiveness after injury. It supports considering the role of sensory input in rehabilitation. [4]

Patient education makes the programme practicable: understanding why to wear the orthosis, which movements to perform, how to monitor the skin and when to request adjustment. Written or video instructions complement demonstration and checking understanding.

The Liverpool experience reports a reduction in CRPS after a series of audits and organisational changes concerning distal radius fractures. These were service evaluations involving a package of measures. The change cannot be attributed solely to advice sheets, nor can the same effect be promised for every hand condition. [5]

# 10. Reassess functional benefit

An orthosis may achieve its mechanical goal while remaining difficult to live with. Assessment must consider range of motion alongside comfort, skin condition, actually tolerated wearing time and activities that matter to the patient. Functional orthoses have a role here, facilitating a task or grasp without unnecessarily immobilising available segments.

At each reassessment, five questions help revise the programme: which structure still limits movement? What loading does it actually receive? Does the patient tolerate this exposure? Does the gain persist between sessions? Does the hand participate better in the target activities?

**The Salt Lake message:** orthosis quality arises from coherence between clinical reasoning, the device fabricated and the patient's experience. The orthosis evolves with the hand, through to return to activities.

# References and image sources

[1] Glasgow C, Ballard E. *A prospective randomised comparative study of dynamic, static progressive and serial static proximal interphalangeal joint extension orthoses.* Hand Therapy. 2022;27(1):22-31. doi:10.1177/17589983211070658.

[2] Colditz JC. *Plaster of Paris: The Forgotten Hand Splinting Material.* Journal of Hand Therapy. 2002;15(2):144-157. doi:10.1053/hanthe.2002.v15.015014.

[3] Punsola-Izard V et al. *A Comparison between Two Intervals of Daily Total End Range Time for Treatment of Proximal Interphalangeal Joint Flexion Contracture Using an Elastic Tension Digital Neoprene Orthosis.* Journal of Clinical Medicine. 2023;12(5):1987. doi:10.3390/jcm12051987.

[4] Roll R et al. *Illusory movements prevent cortical disruption caused by immobilization.* NeuroImage. 2012;62(1):510-519. doi:10.1016/j.neuroimage.2012.05.016.

[5] Gillespie S, Cowell F, Cheung G, Brown D. *Can we reduce the incidence of complex regional pain syndrome type I in distal radius fractures? The Liverpool experience.* Hand Therapy. 2016;21(4):123-130. doi:10.1177/1758998316659676.

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[6] Hirth MJ, Howell JW, O'Brien L. J Hand Ther. 2016;29:405-432. doi:10.1016/j.jht.2016.07.001.

# Illustrations from the original resource

Figure 1



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