Splinting for the prevention and correction of contractures in adults with neurological dysfunction

Practice guideline for occupational therapists and physiotherapists

Royal College of Occupational Therapists and Association of Chartered Physiotherapists in Neurology

Quick Reference and Implementation Guide
Splinting for the prevention and correction of contractures in adults with neurological dysfunction

Quick Reference and Implementation Guide

This guide provides a summary of the recommendations in the Royal College of Occupational Therapists practice guideline *Splinting for the prevention and correction of contractures in adults with neurological dysfunction* and suggestions for implementing the recommendations.

It is intended to be used by practitioners as an easily accessible reminder of the recommendations for intervention and implementation. It should be used once the practitioner has read the full guideline document. This is important to ensure an appreciation and understanding of how the recommendations were developed and their context.

The full practice guideline together with implementation resources can be found on the Royal College of Occupational Therapists website: https://www.rcot.co.uk/practice-resources/rcot-practice-guidelines
Introduction

The objective of this practice guideline is to provide evidence-based recommendations that inform occupational therapists and physiotherapists working with adults with neurological dysfunction when considering the process of splinting for the prevention and correction of contractures. The recommendations are intended to be used alongside the therapist’s clinical expertise in their assessment of need and implementation of interventions. The therapist is, therefore, ultimately responsible for the interpretation of the evidence-based guideline in the context of their specific circumstances and service users. This guideline does not provide practical information on how to undertake splinting.

It is intended that occupational therapists and physiotherapists use this guideline to inform their work with service users, with a particular focus on empowering the service user to fully engage and take responsibility for achieving individual goals. The application of this guideline will also inform the commissioning and delivery of evidence-based services.

This resource provides a quick reference to the guideline recommendations, together with tables outlining the nature of the strength and quality grading categories of the recommendations. Extracts from the full guideline document on the clinical background and an overview of the occupational therapy and physiotherapy role are also provided. Evidence-based recommendations are, however, not intended to be taken in isolation and must be considered in conjunction with the contextual information, and full guideline development methodology, described in the practice guideline document, together with current versions of professional practice documents, of which knowledge and adherence is assumed (COT and ACPIN 2015, p11).

Additionally, this resource provides tips for implementing the guideline’s recommendations, acting as an aid to occupational therapists and physiotherapists wishing to incorporate the knowledge and evidence base contained in the guideline into their practice.

It is intended that this practice guideline provides a comprehensive practical resource for occupational therapists, physiotherapists and the multidisciplinary team working with adults with a neurological health condition who have or are at risk of developing contractures.

As splinting is largely a postgraduate clinical skill, all therapists must ensure they work within their scope of practice and, where appropriate, seek supervision from more senior staff. Practical splinting training should be undertaken as necessary.

1. Clinical background

Contracture is a common secondary complication of paresis and weakness following nervous system damage (Lieber 2010). The inability to move joints through a full range of movement due to weakness is a primary contributor to contracture. To help people maintain their level of function and independence, muscles and joints must maintain their length and range of movement to limit the adverse effects of stiffness from secondary complications (Pitts and O’Brien 2008). Contracture is defined as a limitation in passive range of joint movement (Halar and Bell 1988). Contracture formation is complex, and a number of structures can be involved, including the joint capsule, joint ligaments, muscles and tendons (Farmer and James 2001). Contractures in the early stages of development have been described as having elements of thixotrophy and therefore being more adaptable to change. The term ‘thixotrophy’ has been applied to substances that can be changed from a gel-like substance to a solution after being stirred (Vattanasilp et al 2000). Muscle, although clearly not a gel or solution, has been described as behaving as a thixotropic substance in that its stiffness depends on the history of limb movement. Lakie and Robson (1988) found that when stretch was applied to a relaxed muscle that had been maintained in a shortened position, initial resistance to movement was high. Conversely, with muscle in a lengthened position, the initial resistance was lower. Clinically an increased resistance to passive movement would be felt on initially moving a limb;
after stretch has been applied, however, this relative stiffness is decreased. Over time, contractures may develop and the muscle is then less amenable to alteration.

In addition, the presence of positive signs of the upper motor neuron syndrome (UMNS) i.e. spasticity, can play a role in the development of non-neural adaptations seen with decreasing range of movement (Ada et al 2006, Kilbride and Cassidy 2011). Spasticity is defined as a disordered sensori-motor control resulting from an upper motor neuron lesion, presenting as intermittent or sustained involuntary activation of muscles (Pandyan et al 2005).

**Splinting** is an intervention used in the prevention and correction of contracture in adults with a neurological condition (Coppard and Lohman 2008, Edwards and Charlton 2002). Splinting is defined as the ‘application of external devices designed to apply, distribute or remove forces to or from the body in a controlled manner, to perform one or both functions of control of body motion and alteration or prevention in the shape of the body tissue’ (Rose 1986). The focus of this guideline is alteration or prevention in the shape of body tissue. Splinting may be applied for the control of body motion by therapists or orthotists, but this is not covered in this guideline.

In the context of this guideline, the aim of splinting is to correct and prevent contractures and in doing so facilitate improved function through increased range of movement. The rationale underpinning splinting is to provide a prolonged stretch to maintain or promote change in a body structure (the theoretical basis of splinting is explored in more detail in Section 3 of the full guideline). Depending on the rationale for splinting and the individual clinical presentation, splinting may be used in conjunction with other therapeutic adjuncts such as botulinum toxin or a regular standing programme. In some cases where contracture has become established resulting in fixed joint deformity, conservative means (i.e. splinting) are not sufficient to produce change where this is the goal. In these instances, it may be appropriate to consider surgical intervention; this does not fit within the remit of this document and will require referral to an orthopaedic surgeon. Following splinting or surgical intervention for contracture, long-term orthotic provision may be required for continued maintenance of joint range and function. Referral to an orthotist as part of overall multidisciplinary management is strongly recommended.

In this guideline, **splinting** is the term used to describe the **process** of applying a prolonged stretch through the application of a range of devices. Most commonly, but not exclusively, a **splint** is made from thermoplastic material. In addition, prefabricated splints are sometimes used and are selected for or adapted to the individual. A **cast** is usually made from fibreglass casting tape or plaster of Paris; it is usually cylindrically applied and non-removable. However in certain instances casts may be bi-valved (cut in half) or made to be removable (Conine et al 1990). Both splints and casts can be serially adjusted to accommodate gains in range of movement. In addition, devices are available that are angle adjustable, which may also be useful in applying prolonged stretch. For clarity, the term ‘orthoses’ refers to all external devices, including splints and casts, but is commonly accepted in practice to mean devices provided by orthotists, usually for long-term management.

### 2. The occupational therapy and physiotherapy role

Occupational therapists and physiotherapists, as members of the wider health and social care team, play a key role in the management of long-term neurological conditions. As part of a comprehensive goal-directed rehabilitation or management programme, splinting can be a useful adjunct in the therapist’s toolbox in the prevention and correction of contractures.

Both professions are committed to a person-centred and holistic philosophy. The core essence of the roles is described by their professional bodies as follows:

*Occupational therapy provides practical support to empower people to facilitate recovery and overcome barriers preventing them from doing the activities (or occupations) that matter to them. This support increases people’s independence and satisfaction in all aspects of life.*

(https://www.rcot.co.uk/about-occupational-therapy/what-is-occupational-therapy)

**Physiotherapists help people affected by injury, illness or disability through movement and exercise, manual therapy, education and advice. They maintain health for people of all ages, helping patients**
to manage pain and prevent disease. The profession helps to encourage development and facilitate recovery, enabling people to stay in work while helping them to remain independent for as long as possible.

(https://www.csp.org.uk/careers-jobs/what-physiotherapy)

The decision to develop joint therapy guidance reflects the shared goal to enhance function which is integral to both professions.

3. Guideline recommendations

The recommendations are based on the synthesis of the best available evidence. It should, therefore, be noted that the guideline is not able to be fully reflective of the role of occupational therapy and physiotherapy in the prevention and correction of contractures in adults with neurological dysfunction.

Seven recommendation categories reflect key aspects of occupational therapy and physiotherapy in the prevention and correction of contractures in adults with neurological dysfunction.

The studies from which the recommendations were developed are outlined in evidence tables within the full guideline (Appendix 7). Recommendations are graded A (high) to D (very low) to indicate the quality of the evidence, and the scoring of 1 (strong) or 2 (conditional) indicates the strength of the recommendation – see full guideline for further details of the grading method. A total of 12% of the evidence was graded as high (A), 28% as moderate (B), 36% as low, and 24% as very low (D). All nineteen recommendations are graded as conditional.

### Lower limb

#### Ankle: contracture correction

1. It is suggested that ankle casts are used at end range (for people with ABI and stroke) for improving range of movement at the ankle joint.


2. It is suggested that ankle casts are applied at end range to improve joint range of movement in conjunction with botulinium toxin A (in people with stroke and ABI) when presenting with clinically significant spasticity (see also RCP 2009).


3. It is suggested that adjustable ankle splints applied at end range can be used (in people with stroke and ABI) for improving joint range of movement.

   (Grissom and Blanton 2001 [D] stroke and ABI; Lai et al 2008 [C] ABI and stroke)

4. It is suggested that caution is exercised when considering the use of non-custom-made splints for the correction of contractures (at the ankle in people with stroke and ABI) due to the risk of pressure sores.

   (Grissom and Blanton 2001 [D] stroke and ABI)

#### Ankle: contracture prevention

5. It is suggested that an ankle splint can be used for preventing the loss of range of movement at the ankle joint (in people with stroke) when positioned at plantar grade.

   (Robinson et al 2008 [B] stroke)
6. It is suggested that caution is exercised when considering the use of non-custom-made splints for the prevention of contractures (at the ankle in people with stroke) due to the risk of pressure sores.

   (Robinson et al 2008 [B] stroke)

**Knee: contracture correction**

7. It is suggested that casts may be used for the correction of contracture (in people with ABI and stroke) with the knee joint positioned at end range of movement.


8. It is suggested that short-duration cast application (1-4 days) may produce a lower complication rate than longer duration cast application (4-7 days).

   (Pohl et al 2002 [C] ABI and stroke)

**Knee: contracture prevention**

9. It is suggested that casts at end range of movement at the knee joint may be used (in people with stroke and ABI) for the prevention of contracture.

   (Pohl et al 2002 [C] stroke and ABI)

10. It is suggested that caution is used when considering casts for acute patients (with ABI and stroke) and at lower levels of arousal because of possible risks of secondary complications (e.g. pressure areas).

   (Pohl et al 2002 [C] stroke and ABI)

**Upper limb**

**Hand and wrist: contracture correction**

11. It is suggested that splints should not be used routinely for the correction of range of movement but may be beneficial in selected cases (in people with stroke and ABI).


**Hand and wrist: contracture prevention**

12. It is suggested that splints should not be used routinely to prevent loss in range of movement at the wrist and hand (people with stroke and ABI) but may be beneficial in selected cases.


13. It is suggested that splints in conjunction with botulinum toxin A (in people with stroke and ABI) may reduce spasticity as a component in preventing loss of range of movement in selected cases.

   (Carda and Molteni 2005 [C] stroke and ABI)
14. It is suggested that electrical stimulation of wrist and finger muscles combined with a custom-made wrist and hand splint should not be used routinely to prevent loss in range of movement (in people with stroke or ABI).

(Leung et al 2012 [A] stroke and ABI)

15. It is suggested that a custom-made wrist and hand splint should not be used routinely to prevent the increase (or worsening) of spasticity (in people with stroke and ABI).


16. It is suggested that a splint in a neutral wrist position may be beneficial (for people with stroke) for prevention of hand pain associated with joint malalignment.

(Bürge et al 2008 [A] stroke)

### Elbow: contracture correction

17. It is suggested that casts at end range are used (for people with ABI and stroke) for improving range of movement at the elbow joint.


18. It is suggested that short-duration cast application (1-4 days) may produce a lower complication rate that longer-duration cast application (4-7 days).

(Pohl et al 2002 [C] ABI and stroke)

It is recommended that occupational therapists and physiotherapists participate in national and local audit of neurological services, and use the tool which is available to support this guideline to undertake audit against the information provided in section 6 of this Quick Reference and Implementation Guide.

Information about organisational and financial barriers that may impact on an occupational therapist’s and physiotherapist’s ability to implement the recommendations are outlined in the full guideline (COT and ACPIN 2015, pp48-49).

### 4. Key steps for consideration when splinting adults with contractures

#### Stage 1: Before considering splinting

- Splinting should be regarded not in isolation but as one part of a comprehensive goal-directed rehabilitation or management programme (RCP 2009).
- If relevant, remediable provocative factors for spasticity should be addressed first (e.g. pain, infection) (RCP 2009).

#### Stage 2: Patient selection

- Patients suitable for splinting are those who may have, or may be at risk of, contractures and other treatment strategies are not maintaining joint range of movement.
- Goals of intervention should be identified (e.g. improving range of ankle-dorsiflexion or knee extension to enable standing or range of elbow extension to improve ease of dressing.
- Splinting should not be considered in certain circumstances (ACPIN 1998, Delphi Consultation (Kilbride et al 2013), GDG Consensus), and caution is advised in others (see Boxes 6.1 and 6.2).

#### Stage 3: Agree action plan

- Identify specific splinting intervention to be applied – cast or splint, bespoke or ‘off the shelf’, design (e.g. consider pressure areas, lever
with team lengths, materials used), patient position to optimise application, wearing regime.
- Identify the appropriately skilled person(s) responsible for making/provision of the splint or cast (ISWP 2012, NICE 2013).
- Agree monitoring regime.
- Identify outcome evaluation, including timeframes.

| Stage 4: Before splinting | • Provide appropriate information to patients and carers. See example form in Appendix 6 of the full guideline (COT 2015, p63).
|                          | • Obtain informed consent. In cases where an adult is unable to consent, a consultee process may be applied with the next of kin following discussion with the team, including medical colleagues, and a best interests decision made (COT 2015, CSP 2012).
|                          | • Record baseline measures.

| Stage 5: Splinting procedure | • Make or provide splint or cast.

| Stage 6: Documentation | • Document consent or consultation process (COT 2015, CSP 2012).
|                         | • Document splint or cast application details. See example in Appendix 6 of the full guideline (COT 2015, p64).
|                         | • Document splint or cast monitoring regime. See example in Appendix 6 of the full guideline (COT 2015, p65).
|                         | • Provide personalised application and monitoring information to patient and carers. See example in Appendix 6 of the full guideline (COT 2015, p63).

| Stage 7: Review | • Plan review dates and outcome evaluation (NICE 2013).

### Box 6.1 Identified factors for caution when splinting

#### When splinting is being considered caution is advised:
- If the patient has a vascular disorder.
- If the patient has a concomitant fracture or severe soft tissue injury.
- If the patient is medically unstable.
- If the patient is incontinent.
- If the patient is diagnosed with heterotopic ossification.
- If the patient has acute inflammation.
- If the patient is unable to communicate.
- If the patient has cognitive or behavioural problems.
- If access to the limb is needed for medical procedures.
- If there is uncontrolled intracranial pressure.
- If there is poor skin integrity.
- If there is oedema.
- If there is sensory loss or hypersensitivity.
- If there is a fluctuating or severe tone or spasms.
- If there is a history of deep vein thrombosis.

(ACPIN 1998, Delphi Consultation (Kilbride et al 2013), GDG Consensus 2014)

### Box 6.2 Factors to consider when splinting would not be advised
There was strong consensus in the Delphi Survey (2013) for when splinting would not be indicated:

- If there is no identified benefit.
- If it causes pain or discomfort.
- If there is no clear plan for application, removal or monitoring of the splint.
- If other treatment strategies are working.
- If there is poor patient compliance.
- If there is a lack of follow-up.
- If the contracture has become established resulting in fixed joint deformity. See Appendix 3 of the full guideline for more details (COT and ACPIN 2015, pp57-59).

5. Guideline implementation

In addition to the full guideline document, there are a number of implementation resources available to aid translation into practice, including a CPD resource and an audit tool. Some key tips to consider are outlined in the table below.

<table>
<thead>
<tr>
<th>Key tips</th>
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<tr>
<td>1. Use the evidence available to inform prioritisation where there are service capacity issues which might make translation into practice more challenging (COT and ACPIN 2015, pp48-49).</td>
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<td>2. Look for opportunities to promote the practice guideline with colleagues and multidisciplinary team members: include on the agenda of relevant meetings.</td>
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<tr>
<td>3. Present and discuss the evidence-based recommendations with colleagues – preferably with the multidisciplinary team. A Professional Development Resource PowerPoint is available with information already prepared and can be tailored for your local use.</td>
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<tr>
<td>4. Use the guideline audit tool to benchmark your service/practice and assist in identifying actions to progress implementation of recommendations. An audit tool is available to download and audit your service against the recommendations and kick-start an action plan.</td>
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<tr>
<td>5. Gather evidence of outcomes using standardised assessments and measures.</td>
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<tr>
<td>6. Use the guideline evidence and recommendations to support the case for occupational therapy or physiotherapy as part of your business planning and commissioning activities</td>
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<tr>
<td>7. Write an implementation case study to demonstrate how your service has translated the guideline recommendations into the workplace. Provide supporting performance/outcome data and service user feedback to demonstrate the difference you are making to service users, quality of services and cost-effectiveness. Visit: <a href="http://cotimprovinglives.com/">http://cotimprovinglives.com/</a>.</td>
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The Royal College of Occupational Therapists and the RCOT Specialist Section – Neurological Practice would welcome your feedback on the guideline document and how you are using it in your practice/service. Please email Angie Thompson, R&D Officer, at angie.thompson@rcot.co.uk.

To access the implementation tools visit:
[https://www.rcot.co.uk/practice-resources/rcot-practice-guidelines](https://www.rcot.co.uk/practice-resources/rcot-practice-guidelines)
6. References

The full reference list for the evidence supporting the recommendations, together with the full evidence tables, can be found in the guideline.


