

Nonsurgical Treatment Options for Upper Limb Spasticity



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KEYWORDS

- Rehabilitation • Upper extremity • Muscle spasticity • Muscle hypertonia • Cerebral palsy • Stroke
- Brain injuries • Occupational therapy

KEY POINTS

- The International Classification of Functioning, Disability, and Health is a valuable framework for setting functional goals in rehabilitation.
- Recent research in constraint-induced movement therapy and bimanual therapy shows promising results for upper extremity functional improvement.
- Reduction of spasticity using medications and chemodenervation procedures can maximize upper limb function.
- Technological advances, including robotics and virtual reality platforms, can enhance traditional therapies.
- Coordination of rehabilitation interventions with the surgical team ensures optimal outcomes.

INTRODUCTION

Many nonsurgical options exist for the rehabilitation of upper limb spasticity (ULS). The central focus of rehabilitation is to identify functional goals across multiple domains and develop a comprehensive plan that meets each goal. Age, cause of spasticity, severity, baseline and current functional status, cognitive impairment, family/environmental support, and medical comorbidities are important to consider when setting functional goals. The decision-making process involves the individual, caregivers, occupational therapist, rehabilitation, and the medical and surgical teams. The International Classification of Functioning, Disability, and Health (ICF) is a useful framework to guide management that incorporates an individual's body structure and function, including strength,

spasticity, range of motion (ROM), activities of daily living (ADLs), participation in vocational/community settings, and intrapersonal and environmental factors¹ (Fig. 1).

Spasticity, defined as a velocity-dependent resistance to muscle stretch, is a positive symptom of the upper motor neuron syndrome, which commonly occurs in central nervous system (CNS) disorders, including stroke, spinal cord injury, and cerebral palsy (CP). Muscles that cross 2 joints tend to be disproportionately affected by ULS. The typical pattern of ULS involves the shoulder adductors and internal rotators, forearm pronators, and elbow and wrist flexors. Involvement of the fingers and thumb depends on timing of brain injury. Children with antenatal brain injury may be more likely to retain distal muscle movements, such as grasp and release of the fingers,

Disclosure Statement: Dr D. Gaebler-Spira is a consultant for Rehabtek and receives research funding from Merz (maker of Xeomin) and Allergan (maker of Botox).

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Hand Clin 34 (2018) 455–464

<https://doi.org/10.1016/j.hcl.2018.06.003>

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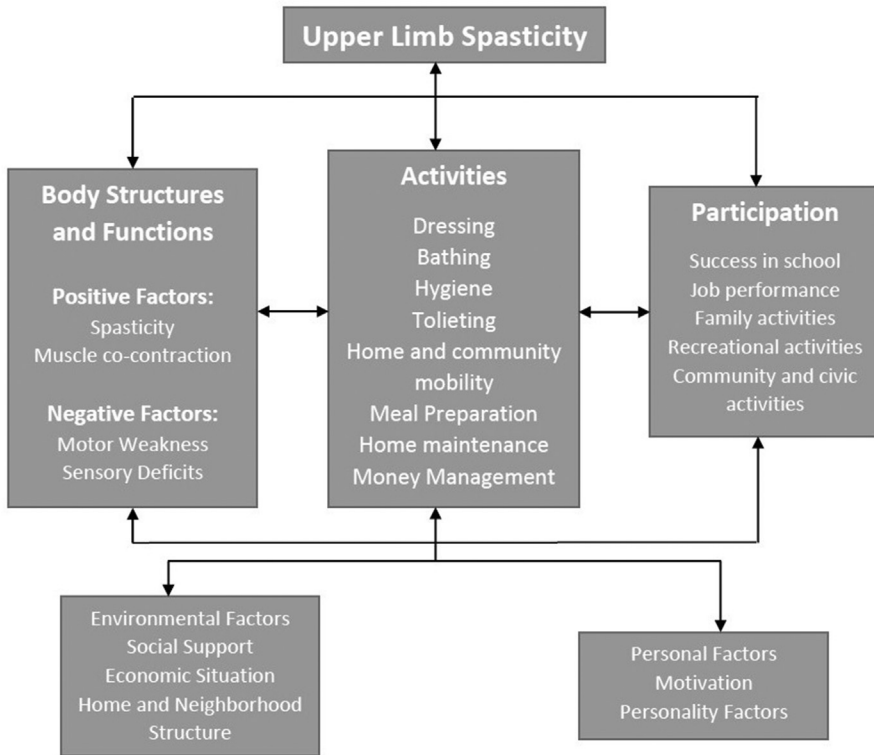


Fig. 1. The functional impact of ULS portrayed using the ICF model.

whereas adults and children with postnatal brain injury occurring after the pruning of corticospinal input during early infancy tend to have distal muscle involvement.^{2,3}

ULS impairs function by limiting active movement and passive ROM of the arm and hand, resulting in a cascade of secondary impairments, including pain and contracture (see Fig. 1).⁴⁻⁶ The rehabilitation plan incorporates prevention of these secondary impairments. Oral medications and neurolytic injections can successfully reduce muscle tone; however, spasticity management must include targeted interventions to address secondary impairments, such as weakness and reduced selective motor control.

This article presents an algorithmic approach to the management of ULS, encompassing evidence-based rehabilitation therapies, medications, and insight into innovations in orthotics and robotics that hold promise in expanding rehabilitation efforts (Fig. 2).

THERAPY INTERVENTIONS

- Patients with ULS should have an assessment with a therapist experienced in upper limb management.

- Constraint-induced movement therapy (CIMT) encourages use of the paretic hand in activities by restraining the opposite hand.
- Bimanual therapy (BMT) facilitates acquisition of skills that use both hands.
- Electrical stimulation (E-Stim) of spastic muscles may improve spasticity and muscle strength.

All children and adults with ULS should be referred to therapy for a functional assessment. This assessment may be provided by an occupational therapist, a physical therapist, or a hand specialist. The therapist provides an assessment of ULS and its secondary symptoms and creates a therapeutic plan to address ROM, stretching, strengthening, and functional goals.

One of the most extensively studied therapies for the paretic upper limb in both adults and children is CIMT, which encourages one-handed activity of the paretic hand and arm by constraining the unaffected upper extremity using a cast or mitt. Multiple systematic reviews have showed that CIMT is more effective than other upper extremity therapies in adults with stroke.⁷⁻⁹ CIMT has also shown benefits in children with hemiplegic CP.^{10,11} Traditional CIMT requires 6 hours per day of cast use for 10 days in a 2-week period.

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