Published in final edited form as:

J Hand Ther. 2013 ; 26(2): 85–86. doi:10.1016/j.jht.2013.01.001.

Innovation in neurological upper extremity rehabilitation

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Medical advances have allowed for greater survivorship and longevity among those afflicted with neurological disorders and disease. However, the residual effects can lead to significant and costly long-term disability impairing quality of life.¹ Among adults who have sustained a stroke, 30–60% have residual hand and upper extremity (UE) dysfunction.² Medical and pharmaceutical interventions often quiet the intrusive abnormal movement and symptoms experienced with Huntington's disease, and Parkinson's disease,^{3,4} but frequently leave impaired hand and UE function.^{5,6} When dysfunction persists over time it can lead to debilitating chronic pain syndromes and dependency on others for performance of daily life tasks. The extent to which therapeutic intervention can ameliorate or temper the devastating long-term effects of neurologically mediated hand and UE impairment is unknown. It is clear that individuals who have sought attention in rehabilitation, now desire specialized and focused care targeted at the challenges imposed by their limited hand and UE function.

This special issue emerged from a need to better understand how hand therapists can effectively improve hand and UE function and reduce the secondary effects of disuse for individuals who are experiencing neurologically mediated dysfunction. It is our goal to introduce the reader to current theories and principles that can be used to guide assessment and intervention for this varied population. Traditionally, the focus of treatment in the neurological setting has been on fostering compensation as opposed to remediation of prehensile skill.⁷ To remediate hand and UE function the astute therapist needs to take into account the myriad of complexities that influence and often impede success. Namely, this cohort of individuals requires innovative practice models that address movement disorders that are impeding function and are congruent with the individual's cognitive and emotional capacities. Thus, effective restoration of hand and UE function calls for the integration of several interrelated abilities with consideration of use-dependent neuroplasticity and principles of motor learning and control.

The three sections of this special issue focused on neurological hand and UE rehabilitation include: (1) a review of overarching concepts in neuroplasticity, motor learning and control; (2) assessment and intervention guidelines for stroke survivors and individuals with neurodegenerative diseases; and (3) a meta-analysis of the benefits of anodal transcranial direct current stimulation. Although the focus of many of the articles is on stroke the reader is encouraged to examine the basic premise(s) of each article and consider how it can be applied across varied neurological disorders or diseases to maximize prehensile skill and function.

When examining the diverse collection of review and research papers in this special issue one should become familiar with current concepts in neuroplasticity and the principles of motor learning and motor control, and appreciate how they can be practically applied. The two papers in the first section serve as a foundation for the issue and as a guideline for practice in the hand therapy setting. The second section begins with a comprehensive framework for post-stroke assessment and a research paper that examined post-stroke reaching self-efficacy. These review papers are followed by three research papers conducted with individuals post-stroke including: patient perspectives on recovery of hand function, the benefits of wrist splinting on wrist contractures and the temporal structure of variability after constraint-induced movement therapy. The last paper in the second section provides a framework for lifetime management of progressive hand and UE dysfunction in individuals with Huntington's disease and Parkinson's disease. The third and final section focuses on innovative treatment methods including a study of the long-term benefit of task-specific practice on UE motor control and a meta-analysis of research conducted on anodal transcranial direct current stimulation for individuals post-stroke. These articles are a just a sample of the exciting work currently underway in neurorehabilitation.

The authors who contributed to this issue have taken great care to identify current perspectives and to introduce the reader to relevant literature in preparation for best practice. Explanations of important theories and principles are provided by the authors so the reader can follow their clinical reasoning process and learn how their decisions are informed. As applicable clinical scenarios or cases are included to provide practical applications for the points made.

We hope you enjoy this journey into neuroscience and rehabilitation for individuals with neurological disorders and disease. Engagement in the process of relearning prehensile skill and function can be appreciated not only by our patients but by ourselves as practitioners, if we keep abreast of current literature and incorporate innovative intervention strategies into practice!

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