

TRIP: Are we Getting "TRIPped Up" by the Specifics of Task-Specific Training.

Course ID 25

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Restoration of motor function is a key goal of rehabilitation for persons with spinal cord injury (SCI). Damage to motor tracts, especially the corticospinal tract, leads to decreased descending drive and diminished volitional motor output. For walking function, the result is a marked decline in the magnitude and rate of muscle force development, with associated decrease in stance phase propulsive force, reduced ability to generate high step frequencies, and limited capacity to respond appropriately to perturbations. For hand function, loss of descending drive results in impaired force-generating capacity and deficits in manual dexterity. While training approaches that emphasize task-specific practice result in some improvement, there are unanswered questions as to whether the aspects of specificity that are emphasized are truly the ones that best promote function. In locomotor training, treadmill-based walking that facilitates longer step lengths reduces the need to generate higher step frequencies. Bodyweight support reduces the peak ground reaction forces and propulsive impulses needed for real-world walking. While the focus of existing training approaches is to replicate the specific kinematics of cyclic locomotor behavior, other elements of walking such as propulsion, step frequency, step variability, and balance are often ignored. Conversely, high-velocity training has the potential to increase central drive to muscles of the lower extremities and facilitate high rates of muscle force development, which may better replicate the coordinated lower extremity angular velocities needed for rapid overground walking and responding to balance perturbations. Participation in intensive, high-velocity motor skill training designed to address limitations of existing locomotor training approaches is associated with improvements in overground walking and balance function in persons with chronic, motor-incomplete SCI (1). In light of the large emphasis on walking, it is striking how few studies have targeted hand function among persons with tetraplegia. As with walking, interventions directed at improving manual strength and dexterity require training that is function-focused. Intensive functional task practice using clinically accessible approaches that increase descending drive appear to have value and potential to be broadly available to those who may benefit (2). Additionally, motivation is a key to optimizing outcomes. Incorporating elements that promote active engagement must be considered. Evidence from pre-clinical models of SCI indicate that training performed at higher intensity yield greater neuromotor benefits than those performed at lower intensity (3) through various mechanisms, including altered cAMP and neurotrophic factor levels that facilitate plasticity-related events within the nervous system (4-5). In this session, course participants will learn about the state of the evidence supporting high-velocity motor training to increase descending drive and enhance motor output. Additionally, participants will learn about the importance of training variability and intensity for optimizing motor outcomes and supporting mechanisms that promote neuroplasticity and motor learning. The opportunity for participant discussion will be provided.

Learning Objective 1 Describe the neural activation that drives motor function, and how training might improve this activation.

Learning Objective 2 Discuss the mechanisms linking specific features of motor training with neuroplasticity in the injured and non-injured nervous system.

Learning Objective 3 Examine how intensive and/or high-velocity training to enhance motor skill acquisition and consolidation might be implemented in the clinical setting.