Restoring Walking in Non-Ambulatory Children with Severe Chronic Spinal Cord Injury

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Introduction

Preliminary findings indicate that locomotor training (LT) can restore walking (e.g. start, step, stop) in an individual with severe, chronic spinal cord injury without restoring voluntary, isolated leg movements. The aim of this study is to test if (1) LT has the capacity to restore ambulation in some children with chronic, severe spinal cord injury (SCI) who have no prognosis for ambulation and exhibit little or no voluntary isolated LE movements, and (2) in the absence of corticospinal tract function, recovery of voluntary locomotion is dependent upon the functional integrity of descending systems from supraspinal motor areas below the cortex.

Experimental

Children who are non-ambulatory with chronic, severe sensorimotor deficits post-SCI undergo 60 sessions of LT with the aim of restoring walking. A battery of clinical tests and neurophysiological approaches, combined with MRI analyses, are used to assess the integrity and function of different levels of the neural axis and in some instances specific pathways that may contribute to recovery of locomotion in these individuals.

Results and Discussion

This subject’s injury is localized at C7 and fibers can be traced into the rostral and caudal edges of the lesion epicenter; with a small population of fibers traversing the lesion. The child recovered walking (step, start, stop) post-LT, though did not recover isolated voluntary leg movement. Lesion imaging of four other subjects tested to date is not shown, though all show no fibers crossing the lesion. Two / four recovered some stepping ability.

Figure 1. Magnetic resonance (T2 weighted) and diffusion tensor imaging of spinal cord injury (3.0 Tesla magnet).

Conclusions

Minimal sparing across the lesion was associated with recovery of walking after severe SCI and LT in one child, but was not definitive in recovery of stepping with two other children. Other neurophysiological tests may be more sensitive.

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References