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Presentation Abstract

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Title:	Mechanosensory effects on hindlimb locomotor function in an in vitro spinal cord-hindlimb rat preparation
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Abstract:

While the spinal cord contains sufficient circuitry for producing locomotion in the absence of sensory feedback, sensory feedback is known to refine spatiotemporal features of motor output to match environmental demands. In vitro preparations, such as the isolated rodent spinal cord, offer many advantages for investigating spinal motor circuitry, but they lack the influences of intact sensory feedback. Here we present a novel mammalian model that combines the neural accessibility of in vitro preparations with the modulatory influence of sensory feedback from physiological hindlimb movement. The model consists of a fully-exposed neonatal rat spinal cord with intact hindlimbs. The cord is oriented dorsal-up with hindlimbs free to step on a custom treadmill. N-methyl D-aspartate and serotonin induced locomotion showed kinematics similar to typical rat locomotion. To the best of our knowledge, this is the first kinematic characterization of in vitro locomotion. Changing orientation and ground interaction (dorsal-up locomotion vs. ventral-up air-stepping) resulted in significant kinematic changes. In each case, the in vitro kinematics were quite similar to those produced under similar mechanical conditions in vivo. Finally, we used two mechanosensory perturbations to demonstrate the importance of maintaining sensory feedback by evidencing its role in patterning in vitro motor output. First, swing assistive forces induced more regular, robust muscle activation patterns. Second, altering treadmill speed induced corresponding changes in stride frequency, confirming that changes in sensory feedback can alter stride timing even in reduced in vitro preparations.

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