Comparison of the effect of robotic reinforced movement learning technology on the development of prone locomotion in infants with and without risk for cerebral palsy.

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Background/Objectives: To determine whether an integration of robotic and sensor technologies self-initiated prone progression crawler (SIPPC), would improve prone locomotion in infants with cerebral palsy (CP).

Study Design: Repeated measures experimental design with 3 groups: experimental group (SIPPC-E), and 2 control groups (SIPPC-T and SIPPC-C). Measures were collected twice a week for 12 weeks. Participants were 27 infants, 4 – 6.6 months old, with or without risk for CP. Inclusion criteria: A TIMP z-score >-1.0 for controls and z-score<-1, a confirmed diagnosis of CP, or positive MRI results for study patients.

Materials/Methods: The SIPPC consists of d*evice-based* wheel position sensors and limb-mounted inertial measurement units (IMUs) that measure movement performance and can be used to trigger locomotion assistance. The patients were randomly assigned to the groups.

Results: The mean distance for all groups increased over the 12 week period with the largest increase in the SIPPC-T group (p=.001) followed by the SIPPC-C group (p=.01). The mean increase for the SIPPC-C group was not statistically significant (p=.067). Correlation coefficients between the movement patterns and the distance traveled ranged from r=.71-.94 for the SIPPC-T, r=.55-.83 for the SIPPC-E, and r=.32-.56 for the SIPPC-C group, respectively.

Conclusions/Significance: The differences in the mean distance travelled by the infants in the SIPPC-E compared to those in the SIPPC-C group suggest that infants as young as 4.5 - 6 months of age are capable of using reinforcement offered by robotic sensors such as the SIPPC to learn a complex and high dimensional movement like prone locomotion.