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Early High-Intensity Gait Training and Functional Outcomes in Pediatric Traumatic Brain Injury

Introduction: Pediatric traumatic brain injury (TBI) represents a substantial public health burden with an estimated 226.4 per 100,000 children sustaining a TBI globally¹. Pediatric TBI can lead to premature deaths and significant long term functional impairments in children, further increasing the burden on the healthcare system. Pediatric patients with moderate to severe TBI demonstrate significant reductions in gait velocity, stride length, cadence, and balance². Current physical therapy protocols for pediatric TBI patients focus on early, gradual return to activity, but intervention characteristics are variable and not well studied. In adult TBI and stroke populations high-intensity gait training (HIGT) focusing on facilitating ambulation at a high intensity defined by a significant increase in heart rate, has been shown to have longer lasting rehabilitative effects on gait distance, endurance, mobility, and cognitive function when compared to traditional physical therapy^{3,4}. The primary objective of this study is to determine if the same effects can be seen in the pediatric TBI population.

Methods: A cohort of 10 pediatric TBI patients including diffuse axonal and anoxic brain injury undergoing HIGT will be compared to 10 retrospective control patients. Data collected will include mechanism of injury, prior level of function, initial Functional Independence Measure for Children (WeeFIM) scores, initial Rappaport Coma Scale scores, time to emergence, initial ambulation distance, and time to achieve key ambulation milestones. These outcomes will be compared to discharge WeeFim scores and ambulation distance following intervention. The intervention will consist of structured high-intensity gait training quantified using heart rate monitors and subjective effort via modified rating of perceived exertion (RPE) scale. Additional clinical indicators of intensity will be observed including increased work of breathing, sweating, and observable gait deviations.

Future Directions: Retrospective control data is in the process of being collected. Once prospective data is collected the cohort will be compared to the retrospective controls to determine if HIGT improved functional mobility outcomes. The results of this study will help inform standardized protocols for pediatric TBI physical therapy. Future directions include expanding cohort size to increase study power and better match controls with cohort patients minimizing variability in mechanism of injury.

Resources:

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2. Kuhtz-Buschbeck JP, Hoppe B, Gölge M, Dreesmann M, Damm-Stünitz U, Ritz A. Sensorimotor recovery in children after traumatic brain injury: analyses of gait, gross motor, and fine motor skills. *Dev Med Child Neurol*. 2003;45(12):821-828. doi:[10.1017/s001216220300152x](https://doi.org/10.1017/s001216220300152x)
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4. Marzolini S, Robertson AD, MacIntosh BJ, et al. Effect of High-Intensity Interval Training and Moderate-Intensity Continuous Training in People With Poststroke Gait Dysfunction: A Randomized Clinical Trial. *J Am Heart Assoc*. 2023;12(22):e031532. doi:[10.1161/JAHA.123.031532](https://doi.org/10.1161/JAHA.123.031532)