NC-10. TRAINING THE BRAIN TO REPAIR ITSELF: AN EXERCISE TRIAL IN PEDIATRIC BRAIN TUMOR SURVIVORS

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BACKGROUND: Children treated with life saving cranial radiation for a brain tumor experience long-term cognitive impairments - including intellectual decline, difficulties in attention, slowed speed of thinking, and memory impairment. These deficits are related to white matter damage and hippocampal atrophy. No intervention has demonstrated significant benefit in ameliorating adverse effects. Recent studies show that aerobic exercise promotes endogenous repair mechanisms in the brain and improves cognitive performance. It is not known whether these benefits translate to brain injury in humans, particularly the significant injury observed in children treated for malignant brain tumors. METHODS: We conducted a quasi-randomized crossover trial of exercise training (n = 18) in children treated for brain tumors with cranial radiation. Training consisted of 90-minute group sessions, 3 times a week for 12 weeks. The primary outcome was change in brain structure. White matter (i.e. fractional anisotropy, FA) and hippocampal volume (mm$^3$) were measured by DTI and structural MRI, respectively. The secondary outcome was change in reaction time and accuracy across CANTAB tests of attention, processing speed, and short term memory. Linear mixed modeling was used to evaluate time, training, and carryover effects. RESULTS: Training effects on brain structure and cognitive performance were observed. Training versus no training resulted in increased white matter organization (difference: 0.05, $P < 0.001$) and total hippocampal volume (difference: 110.04 mm$^3$; $P < 0.001$) and decreased mean reaction time (difference: -434.82 ms, $P < 0.001$). Notably, carryover effects of training were observed. At ~12 weeks after training versus no training, participants continued to exhibit increased white matter organization (difference: 0.07, $P < 0.001$) and total hippocampal volume (difference: 207.76 mm$^3$; $P < 0.001$), and a decreased mean reaction time (difference: -1084.74 ms, $P < 0.01$). There were no significant changes in accuracy. CONCLUSIONS: Aerobic exercise is an effective means of promoting brain repair and cognitive restoration in children treated with cranial radiation for brain tumors.