Mild Traumatic brain injury (mTBI) is a signature wound in military personnel, and repetitive mTBI has been linked to age-related neurodegenerative diseases that affect white matter (WM) in the brain [1].

Learning involves changes in strength of synapses, the connections between neurons in gray matter. But human brain imaging using magnetic resonance imaging (MRI) has revealed structural changes in white matter after learning complex tasks. This raises the question of whether white matter responds to experience in a manner that affects neuron function under normal circumstances, thereby affecting information processing and performance. There are a few intriguing observations related to this possibility. For example, structural changes in white matter correlate with the number of hours a professional musician practices.

The greatest changes were seen in parts of the brain that were not yet fully myelinated. Similarly, adult subjects showed increased white matter structural organization in a brain region important for visuo-motor control 6 week after learning to juggle.

And in a study of adults learning to read, the volume, anatomical organization, and functional connectivity of white matter tracts linking cortical regions important for reading were increased.

Whether these changes in white matter structure affect neuron function directly by altering transmission of information required for acquiring a skill is not clear. However, the observations do show that learning a new skill is associated with altered white matter structure in the mature brain [2].

The cumulative effects of repetitive subclinical head impacts during sports may result in chronic white matter (WM) changes and possibly, neurodegenerative sequelae. In a pilot study, Yuan et al. investigated the longitudinal WM changes over the course of two consecutive high-school football seasons and explored the long-term effects of a jugular vein compression collar on these WM alterations. Diffusion tensor imaging data were prospectively collected both pre- and postseason in the two consecutive seasons. Participants were assigned into either collar or noncollar groups. Tract-based spatial statistics (TBSS) approach and region of interest-based approach were used to quantify changes in WM diffusion properties. Despite comparable exposure to repetitive head impacts, significant reductions in mean, axial, and/or radial diffusivity were identified in Season 1 in multiple WM regions in the noncollar group but not in the collar group. After an 8- to 9-month long off-season, these changes observed in the noncollar group partially and significantly reversed but also remained significantly different from the baseline. In Season 2, trend level WM alterations in the noncollar group were found but located in spatially different regions than Season 1. Last, the WM integrity in the collar group remained unchanged throughout the four time points. In conclusion, we quantitatively assessed the WM structural changes and partial reversal over the course of two consecutive high-school football seasons. In addition, the mitigated WM alterations in athletes in the collar group might indicate potential effect of the collar in ameliorating the changes against repetitive head impacts [3].

[1]
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