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# Diffusion Tensor Imaging Findings in Pediatric Patients with Mild Traumatic Brain Injury

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## INTRODUCTION

Approximately 14% of school age children with sports-related concussions (SRC) remain symptomatic 3 months after injury. Previous studies have used diffusion tensor imaging (DTI) to detect white matter tract changes in regions of interest in symptomatic patients; however data in the pediatric population remains limited. This study was undertaken to determine whether DTI metrics can provide valuable information in pediatric mTBI patients with persistent symptoms

## MATERIAL AND METHODS

Twenty-nine adolescents (19 male, 10 female) who sustained a SRC and 24 controls (11 male, 13 female) were enrolled in the study. 3D T1 weighted images and DTI were acquired and maps of fractional anisotropy (FA), mean diffusivity (MD), axial and radial diffusivity (AD, RD) were calculated. Subject maps were warped to a template with labelled ROIs using ANTs. Regions analyzed were the genu, splenium, body of the corpus callosum (CC), inferior longitudinal fasciculus (ILF), posterior limb of the internal capsule, superior longitudinal fasciculus, cingulum, corona radiata (CR), unicate fasciculus and cerebral peduncle. Mean FA, AD, RD, and MD values were extracted for each ROI. To improve our sensitivity we manually defined ROIs in the CR, genu, ILF, splenium, and CC. Statistical differences between patient and control were determined using an unpaired t-test where  $p < 0.05$  was considered significant.

## RESULTS

Results of the automated ROI analysis showed elevated AD values in the CR. Manually drawing the ROIs reduced the inclusion of non-white matter and subsequently, we saw larger differences in the mean DTI metrics between controls and SRC subjects. Results of the manual ROI analysis showed decreased FA values in the genu, ILF, and splenium; elevated AD values in the CR and splenium; elevated RD values in the genu, splenium and ILF; and elevated MD values at the genu and splenium, suggesting axonal injury

## CONCLUSION

Patients with persistent SRC symptoms are in danger of developing progressive neurodegeneration that may lead to behavioral changes, cognitive deficits and memory loss. The findings of this study are encouraging as the methods can potentially be used in a way to track changes in brain injury that may not be detectable with conventional imaging methods.

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