

Global and regional white matter development in early childhood

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Abstract

White matter development continues throughout childhood and into early adulthood, but few studies have examined early childhood, and the specific trajectories and regional variation in this age range remain unclear. The aim of this study was to characterize developmental trajectories and sex differences of white matter in typically developing young children. Three hundred and ninety-six diffusion tensor imaging datasets from 120 children (57 male) aged 2–8 years were analyzed using tractography. Fractional anisotropy (FA) increased and mean diffusivity (MD) decreased in all white matter tracts by 5–15% over the 6-year period, likely reflecting increases

in myelination and axonal packing. Males showed steeper slopes in a number of brain areas. Overall, early childhood is associated with substantial development of all white matter and appears to be an important period for the development of occipital and limbic connections, which showed the largest changes. This study provides a detailed characterization of age-related white matter changes in early childhood, offering baseline data that can be used to understand cognitive and behavioural development, as well as to identify deviations from normal development in children with various diseases, disorders, or brain injuries.

Keywords: Neurodevelopment, Brain, White matter, Diffusion tensor imaging, Preschool, Early childhood, Children