Stimulant Treatment Trajectories Are Associated with Neural Reward Processing in Attention-Deficit/Hyperactivity Disorder.

Lizanne J. S. Schweren, PhD; Annabeth Groenman, PhD; Daniel von Rhein, PhD; Wouter Weeda, PhD; Stephen F. Faraone, PhD; Marjolein Luman, PhD; Hanneke van Ewijk, PhD; Dirk J. Heslenfeld, PhD; Barbara Franke, PhD; Jan K. Buitelaar, MD, PhD; Jaap Oosterlaan, PhD; Pieter J. Hockstra, MD, PhD; and Catharina A. Hartman, PhD


Abstract

OBJECTIVE:
The past decades have seen a surge in stimulant prescriptions for the treatment of attention-deficit/hyperactivity disorder (ADHD). Stimulants acutely alleviate symptoms and cognitive deficits associated with ADHD by modulating striatal dopamine neurotransmission and induce therapeutic changes in brain activation patterns. Long-term functional changes after treatment are unknown, as long-term studies are scarce and have focused on brain structure. In this observational study (2009-2012), we investigated associations between lifetime stimulant treatment history and neural activity during reward processing.

METHODS:
Participants fulfilling DSM-5 criteria for ADHD (N = 269) were classified according to stimulant treatment trajectory. Of those, 124 performed a monetary incentive delay task during magnetic resonance imaging, all in their nonmedicated state (nEARLY&INTENSE = 51; nLATE&MODERATE = 49; nEARLY&MODERATE = 9; nNAIVE = 15; mean age = 17.4 years; range, 10-26 years). Whole-brain analyses were performed with an additional focus on the striatum, concentrating on the 2 largest treatment groups.

RESULTS:
Compared to the late-and-moderate treatment group, the early-and-intense treatment group showed more activation in the supplementary motor area and dorsal anterior cingulate cortex (SMA/dACC) during reward outcome (cluster size = 8,696 mm³; PCLUSTER < .001). SMA/dACC activation of the control group fell in between the 2 treatment groups. Treatment history was not associated with striatal activation during reward processing.

CONCLUSIONS:
Our findings are compatible with previous reports of acute increases of SMA/dACC activity in individuals with ADHD after stimulant administration. Higher SMA/dACC activity may indicate that patients with a history of intensive stimulant treatment, but currently off medication, recruit brain regions for cognitive control and/or decision-making upon being rewarded. No striatal or structural changes were found.