

Association of Nucleus Accumbens Neurofeedback Performance with Reward-Related Constructs in Young Adults

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Introduction

While reward responsivity is thought to peak in adolescence, the ability to flexibly regulate this responsivity appears to continue to grow throughout late adolescence into young adulthood. In recent work, we demonstrated that both adolescents and young adults demonstrate the capacity to regulate NAcc activity during a real-time functional magnetic resonance imaging (fMRI) neurofeedback task, but young adults exhibited stronger differentiation between increase and decrease trials than adolescents did. Little is known about how this age-related difference in regulatory ability is related to other reward-related constructs. Here, we build on our prior work by examining associations between NAcc modulation during feedback runs and measures of reward anticipation and approach-related response bias.

Methods

A community sample of adolescents (n=62; aged 14–16) and young adults (n=75; aged 25–27) participated in a study that included a real-time fMRI NAcc neurofeedback task, an in-scanner monetary incentive delay (MID) task, and a behavioral Emotional Go/No-Go task with happy and calm faces. NAcc percent signal change during the first 10 seconds of each neurofeedback trial was calculated and averaged separately for increase and decrease trials. NAcc β weights were extracted for MID events of interest (e.g., Large Reward Anticipation). D-prime and criterion scores were calculated from behavioral performance on the Go/No-Go to measure emotion discrimination and approach-related response bias, respectively. After exclusions for missing data and poor behavioral performance, n=49 adolescents and n=65 young adults were included in these analyses.

Results

Young adults who were better able to downregulate NAcc during decrease trials showed less NAcc activation during reward anticipation ($\beta=1.73$, $SE=0.66$, $p=.01$) on the MID task. No relationship between NAcc downregulation success and NAcc reward anticipation was found for adolescents ($p=.58$). Neither age group showed a significant relationship between NAcc upregulation success and NAcc reward anticipation. Similarly, among young adults, NAcc percent signal change during decrease trials was negatively correlated with criterion scores during Happy No-Go condition ($r = -.31$, $p=.01$), such that better down-regulators showed less approach-related response bias. In adolescents, the relationship between downregulation performance and approach bias was not significant.

Conclusions

Taken together, our results suggest downregulation of NAcc during neurofeedback indexes a regulatory ability that is related, in young adults, to other reward-related constructs. The pattern of findings suggests that greater reward anticipation and approach-related response bias may be associated with more difficulty suppressing NAcc activity under feedback conditions. A limitation is our lack of data from late adolescence. Future studies in this age group may help better understand the developmental trajectory of this ability.

