

## Increasing dopamine in brain's frontal cortex decreases impulsive tendency: research

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Raising levels of the neurotransmitter dopamine in the frontal cortex of the brain significantly decreased impulsivity in healthy adults, in a study conducted by researchers at the Ernest Gallo Clinic and Research Center at the University of California, San Francisco.

"Impulsivity is a risk factor for addiction to many substances, and it has been suggested that people with lower [dopamine levels](#) in the [frontal cortex](#) tend to be more impulsive," said lead author Andrew Kayser, PhD, an investigator at Gallo and an assistant professor of neurology at UCSF. "We wanted to see if we could decrease impulsivity by raising dopamine, and it seems as if we can."

The study was published on July 4 in the [Journal of Neuroscience](#).

In a double-blinded, [placebo](#)-controlled study, 23 adult research participants were given either tolcapone, a medication approved by the [Food and Drug Administration](#) (FDA) that inhibits a dopamine-degrading enzyme, or a placebo. The researchers then gave the participants a task that measured impulsivity, asking them to make a hypothetical choice between receiving a smaller amount of money immediately ("smaller sooner") or a larger amount at a later time ("larger later"). Each participant was tested twice, once with tolcapone and once with placebo.

Participants – especially those who were more impulsive at baseline – were more likely to choose the less impulsive "larger later" option after

taking tolcapone than they were after taking the placebo.

Magnetic resonance imaging conducted while the participants were taking the test confirmed that regions of the frontal cortex associated with decision-making were more active in the presence of tolcapone than in the presence of placebo.

"To our knowledge, this is the first study to use tolcapone to look for an effect on impulsivity," said Kayser.

The study was not designed to investigate the reasons that reduced dopamine is linked with impulsivity. However, explained Kayser, scientists believe that impulsivity is associated with an imbalance in dopamine between the frontal cortex, which governs executive functions such as cognitive control and self-regulation, and the striatum, which is thought to be involved in the planning and modification of more habitual behaviors.

"Most, if not all, drugs of abuse, such as cocaine and amphetamine, directly or indirectly involve the dopamine system," said Kayser. "They tend to increase dopamine in the striatum, which in turn may reward impulsive behavior. In a very simplistic fashion, the striatum is saying 'go,' and the frontal cortex is saying 'stop.' If you take cocaine, you're increasing the 'go' signal, and the 'stop' signal is not adequate to counteract it."

Kayser and his research team plan a follow-up study of the effects of tolcapone on drinking behavior. "Once we determine whether drinkers can safely tolerate this medication, we will see if it has any effect on how much they drink while they're taking it," said Kayser.

Tolcapone is approved as a medication for Parkinson's disease, in which a chronic deficit of [dopamine](#) inhibits movement.

Provided by University of California, San Francisco

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