

Moral Decision-Making in Adolescents with Tourette Syndrome

Altered social cognition may be a key feature of Tourette syndrome (TS), and there is speculation that TS is a disorder of a social decision-making network.^{1,2} These concepts predict that moral reasoning (MR), the mental faculty for assessing right and wrong in social contexts, is affected in TS. MR may involve the affective cognitive functions of

empathy and negative emotions and the non-affective cognitive function of self-control. These functions are positively associated with greater sensitivity to ethical violations.^{3,4} Evidence exists for enhanced emotional empathy, but reduced cognitive empathy, and increased impulsivity in TS.^{5,6} Whether MR is altered and how these altered cognitive functions are related to MR were not explored previously in TS subjects. Based on the prior findings of reduced cognitive empathy and heightened impulsivity, we hypothesized that TS adolescents would exhibit greater tolerance of ethical violations.

MR was assessed in 21 untreated TS adolescents without confounding comorbidities and 21 age-matched healthy controls (for

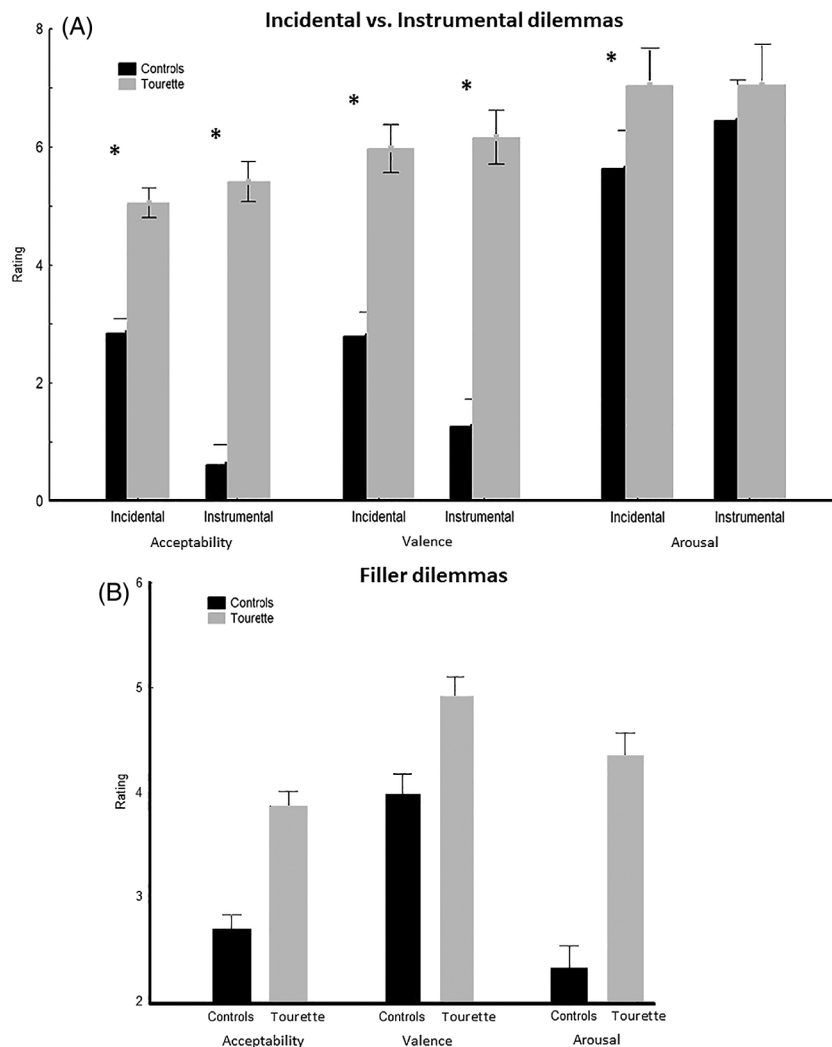


FIG. 1. (A) The figure shows acceptability, valence, and arousal ratings for TS and controls dealing with *incidental* and *instrumental* moral dilemmas. (B) The figure shows acceptability, valence, and arousal ratings for TS and controls dealing with *filler* moral dilemmas. *Acceptability* rating was measured via an eight-point scale (0 = not at all, 7 = completely); *Arousal* rating was measured (ie, the degree of calm/activation) via a nine-point scale (1 = calm, 9 = activation); *Valence* rating was measured (ie, the degree of pleasantness/unpleasantness) via a nine-point scale (1 = dislike, 9 = like) for the resolutions suggested in the dilemmas. Asterisk indicates a significant difference in the post hoc comparison.

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Received: 22 March 2021; Revised: 3 June 2021; Accepted: 4 June 2021

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Published online 21 June 2021 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/mds.28705

Relevant conflicts of interest/financial disclosures: Nothing to report.

details, see Supporting Information). To study moral decision-making, we used a small set of differing moral dilemmas: *incidental* (sacrifice of one person is an expected but unwanted consequence of actions saving a greater number); *instrumental* (sacrifice of one is essential to save a greater number), and *filler* (dishonest behaviors) dilemmas (reference 7, see Supporting Information). Each dilemma scenario is accompanied by questions exploring moral acceptability, valence, and arousal ratings (see Supporting Information). Responses to *filler* dilemmas were separately analyzed because they did not include a distinction between self and other involvement (for full results, see Supporting Information).

Instrumental-Incidental

Acceptability: The *group* \times *type of dilemma* interaction term was significant [$F(1,40) = 139.0, P < 0.001, \eta_p^2 = 0.776$]. Post hoc comparison reported higher score in TS compared to controls for both types of dilemmas (*incidental*: $P = 0.001$; *instrumental*: $P < 0.001$, Fig. 1A). A significant difference between incidental and instrumental dilemmas is reported only for the control group ($P < 0.001$).

Valence: The *group* \times *type of dilemma* interaction term was significant [$F(1,40) = 111.3, P < 0.001, \eta_p^2 = 0.735$]. A post hoc comparison reported a higher score in TS compared to controls for all types of dilemmas ($P < 0.001$, Fig. 1A). A significant difference between incidental and instrumental dilemmas is reported only for the control group ($P < 0.001$).

Arousal: The *group* \times *type of dilemma* interaction term was significant [$F(1,40) = 6.790, P = 0.012, \eta_p^2 = 0.145$]. A post hoc comparison reported a higher score in TS compared to controls for incidental dilemmas ($P = 0.003$), whereas no difference was reported for instrumental dilemmas ($P = 0.756$, Fig. 1).

Filler

Acceptability: ANOVA (one-way analysis of variance) documented a main effect of the *group* [$F(1,40) = 36.26, P < 0.001, \eta_p^2 = 0.473$], with a higher score in TS compared with controls (Fig. 1B).

Valence: ANOVA documented a main effect of *group* [$F(1,40) = 12.35, P < 0.001, \eta_p^2 = 0.235$], with a higher score in TS compared with controls (Fig. 1B).

Arousal: ANOVA documented a main effect of *group* [$F(1,40) = 42.65, P < 0.001, \eta_p^2 = 0.516$], with a higher score in TS compared with controls (Fig. 1B).

We documented a greater tolerance of unethical behaviors in TS adolescents compared to controls. This was present in most

scenarios and derived measures. Reduced moral disapproval (MD) of ethical violations in TS is consistent with prior evidence of reduced cognitive empathy and increased impulsivity,^{5,6} which is associated with reduced MD in healthy humans.^{3,4} Reduced MD is surprising in view of enhanced emotional empathy in TS.⁵ This result suggests that affective processes play a marginal role in determining the MR abnormalities in TS. Our results are consistent with the suggestions that TS is characterized by deficits in social reasoning and abnormalities of the decision-making network.^{1,2} ■

Data Availability Statement

Data available on request due to privacy/ethical restrictions

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Supporting Data

Additional Supporting Information may be found in the online version of this article at the publisher's web-site.