

ROLE OF THE DORSAL AND SUBGENUAL CINGULATE CORTEX IN REWARD-BASED DECISIONS

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INTRODUCTION: The dorsal anterior cingulate cortex (dACC) and subgenual anterior cingulate cortex (sgACC) have been implicated in cognitive processes involved in integrating relevant contextual information with the selection of appropriate motor responses. However, there is little direct evidence in humans to support the role of dACC in linking such information with behavior.

METHODS: We performed single-unit recordings from the dACC of 5 subjects undergoing planned surgical cingulotomy, and from the sgACC of 2 subjects undergoing sub-caudate tractotomy. During recordings, the subjects performed a sequential two-choice selection task where they made joystick movements in response to visual cues signifying that they had received either a standard or reduced monetary reward.

RESULTS: A total of 134 neurons were recorded from dACC and 41 from sgACC. In dACC, 32% of cells demonstrated increased activity during the instruction interval, whereas only 10% had increased activity during the delay interval. In contrast, only 7% of sgACC neurons were modulated during the instruction interval but 27% were modulated during the delay interval just prior to movement onset (t-test, $p < 0.05$). In both areas, the majority of cells responded selectively to trials in which reward was reduced, and only a few responded when the reward was unchanged (ANOVA, $p < 0.05$). In addition, activity during the feedback period was predictive of the movement ultimately made. Following dACC ablation, subjects made selectively more errors when required to change movement based on reward reduction.

CONCLUSIONS: These findings suggest that ACC in humans plays an important role in linking reward-related information with action. Moreover, dACC and sgACC appear to subservise distinct functions in selecting and executing motor responses based on monetary reward. Thus, dACC appears to be more important in the perception of reward, whereas sgACC is more involved in movement selection following reward.