INTRODUCTION

Saccadic eye movements rapidly realign the center of gaze to objects of interest. Voluntary saccades arise from eye fields of the prefrontal cortex (FEF) (Bruce and Goldberg 1985; Bruce et al. 1985b; Schall 1997). FEF neurons have direct access to the superior colliculus (SC) a midbrain structure considered part of the final common pathway for voluntary and reflexive saccades (Moschovakis et al. 1996; Sommer and Wurtz 2000, 1998; Sparks 1986; Sparks and Hartwich-Young 1989). The FEF also has projections to structures in the brainstem involved in saccades (Stanton et al. 1988). Thus, the coordinated activity of the FEF-SC and the FEF-brainstem pathways underlies the generation of voluntary saccadic eye movements (Hanes and Wurtz 2001; Schiller 1998; Schiller et al. 1980, 1979).

A lesser understood pathway arising from FEF courses through the basal ganglia (BG). Indeed, most of the cerebral cortex projects to the input nuclei of the BG, the caudate and putamen (collectively the striatum) (Alexander et al. 1986; Nambu et al. 2002; Parthasarathy et al. 1992; Selemon and Goldman-Rakic 1985). For saccades, the inputs from FEF and dorsomedial frontal cortex or supplementary eye fields (DMFC and SEF) provide the principal input (Parthasarathy et al. 1992). One of the two output nuclei of the BG is the substantia nigra pars reticulata (SNr). Our current understanding of the role of the BG in eye movement control proposes that the command to initiate a voluntary saccade arises first in FEF neurons. Caudate neurons receiving FEF input are activated by the cortical drive. These caudate neurons in turn, are directly connected to the SNr (Hikosaka and Sakamoto 1986; Hikosaka et al.