

Neck Muscles in the Rhesus Monkey. II. Electromyographic Patterns of Activation Underlying Postures and Movements

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Received 4 December 2000; accepted in final form 5 July 2001

Corneil, Brian D., Etienne Olivier, Frances J. R. Richmond, Ger-ald

E. Loeb, and Douglas P. Munoz. Neck muscles in the rhesus monkey. II. Electromyographic patterns of activation underlying postures and movements. *J Neurophysiol* 86: 1729–1749, 2001. Electromyographic (EMG) activity was recorded in 12 neck muscles in four alert monkeys whose heads were unrestrained to describe the spatial and temporal patterns of neck muscle activation accompanying a large range of head postures and movements. Some head postures and movements were elicited by training animals to generate gaze shifts to visual targets. Other spontaneous head movements were made during orienting, tracking, feeding, expressive, and head-shaking behaviors. These latter movements exhibited a wider range of kinematic patterns. Stable postures and small head movements of only a few degrees were associated with activation of a small number of muscles in a reproducible synergy. Additional muscles were recruited for more eccentric postures and larger movements. For head movements during trained gaze shifts, movement amplitude, velocity, and acceleration were correlated linearly and agonist muscles were recruited without antagonist muscles. Complex sequences of reciprocal bursts in agonist and antagonist muscles were observed during very brisk movements. Turning movements of similar amplitudes that began from different initial head positions were associated with systematic variations in the activities of different muscles and in the relative timings of these activities. Unique recruitment synergies were observed during feeding and head-shaking behaviors. Our results emphasize that the recruitment of a given muscle was generally ordered and consistent but that strategies for coordination among various neck muscles were often complex and appeared to depend on the specifics of musculoskeletal architecture, posture, and movement kinematics that differ substantially among species.