# MOTOR CORTICAL CONTROL OF HUMAN JAW MUSCLES

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# ABSTRACT

The human jaw muscles exhibit precise control during mastication and speech. By analogy with the limbs, this control is probably mediated from the motor cortex via corticomotoneuronal (CM) cells, however CM cells have not been unambiguously demonstrated for the trigeminally innervated jaw muscles, and their characteristics have not been described in detail. In this study I have investigated the existence, nature and function of CM cells innervating the human masseter muscle during voluntary movements and reflexes.

Masseter CM projections were examined by a) comparing motor evoked potentials (MEPs) elicited concurrently in the surface electromyograms (EMG) of both masseter muscles by focal transcranial magnetic stimulation (TMS) of one hemisphere of the motor cortex; b) comparing responses of individual masseter motoneurons to TMS of the contra- and ipsi-lateral motor cortex, and; c) examining co-variation in left and right masseter MEP size on a trial-by-trial basis, to identify branched CM neurons (an analysis first tested in two situations where branched CM projections were known to exist). Masseter CM cell function was examined by assessing CM cell involvement during a) bilateral *vs.* unilateral biting and b) the masseter long latency stretch reflex (LLSR).

Two types of CM projections were identified in the control of human masseter. Larger MEPs were elicited in the surface EMG from the masseter contralateral to the TMS, and most low threshold motor units in masseter were excited at a monosynaptic latency. This suggested a population of CM neurons with exclusively contralateral projections to masseter motoneurons. However, bilateral masseter MEPs were elicited in the surface EMG following focal TMS and some masseter motoneurons were identified with

excitatory input from both hemispheres of the motor cortex. Co-variation in left and right masseter MEPs suggested that some CM neurons branch to innervate masseter motoneuron pools on each side.

CM cells from each hemisphere were shown to have distinct roles during the biting tasks; unilateral biting was associated with a reduced activity of CM cells in the contralateral, but not the ipsilateral cortex. By combining muscle stretch with TMS, I found no evidence for CM cell involvement in the masseter LLSR.