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## Introduction

We recently reported (Riddle et al. 2009) inputs from the reticulospinal tract to motoneurons in primates.

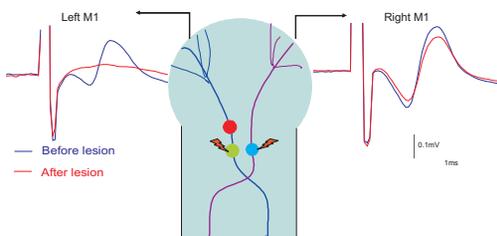
This included cells innervating hand muscles, which was unexpected; control of the hand is usually assigned to the corticospinal tract in higher primates.

Our findings raised the exciting possibility that the reticulospinal tract could subserve recovery of hand use following corticospinal lesion.

## Methods

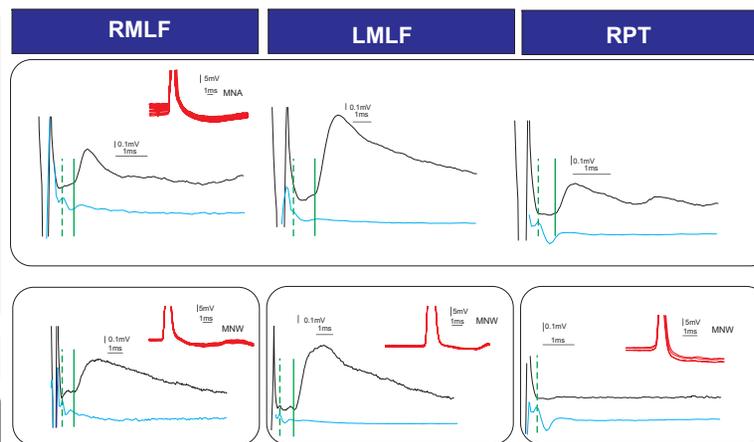
- We made unilateral lesions of the left medullary pyramidal tract (PT) in three monkeys and allowed recovery.
- Six months later we recorded intracellularly from 168 right side cervical motoneurons under terminal anaesthesia.
- Cells were antidromically identified by stimulation through cuff electrodes as projecting either to forearm or hand muscles.
- Synaptic inputs measured following stimulation of the right and left medial longitudinal fasciculus (MLF, containing many reticulospinal axons) and the intact right PT.
- Motoneuron responses were classified as monosynaptic (segmental latency <1ms, followed stimulus trains) or disynaptic (segmental latency >1ms).

## Technique for PT lesion



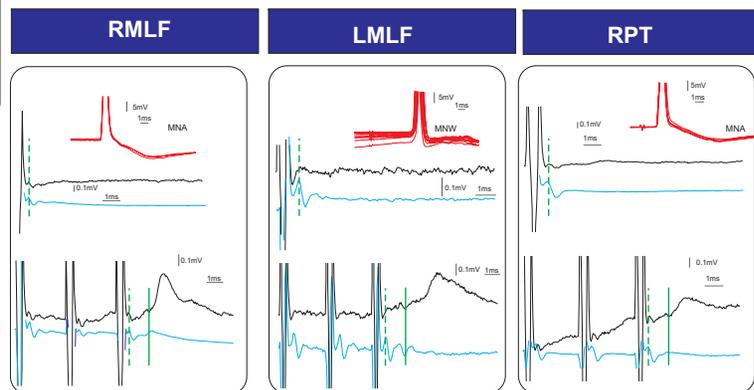
- Left and right PT stimulated, antidromic field recorded from left and right M1.
- Lesion probe implanted rostral to the left stimulating electrode.
- Lesion probe temperature raised to 60-70 °C for 20s; between 1 and 4 lesions made.
- The right antidromic field was slightly reduced, and the left completely abolished.

## Monosynaptic EPSPs



Examples of monosynaptic EPSPs recorded from a proximal motoneuron (top) and three different intrinsic hand motoneurons (bottom). Responses to 1 shock 300µA to RMLF (left), LMLF (middle) and RPT (right). MNA (Median Nerve at the Arm) project to forearm flexors; MNW (Median Nerve at the Wrist) and UNW (Ulnar Nerve at the Wrist) project to intrinsic hand muscles. Red: superimposed antidromic activation from the stimulated nerves. Black: intracellular recording. Blue: corresponding epidural volley. Segmental latencies were measured from the first inflection of the corresponding epidural volley (vertical green dashed line) to the onset of the postsynaptic response (vertical green solid line).

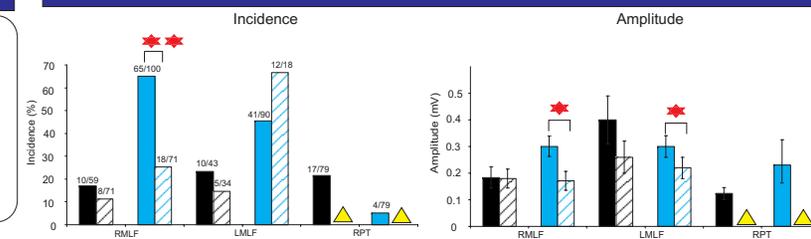
## Disynaptic EPSPs



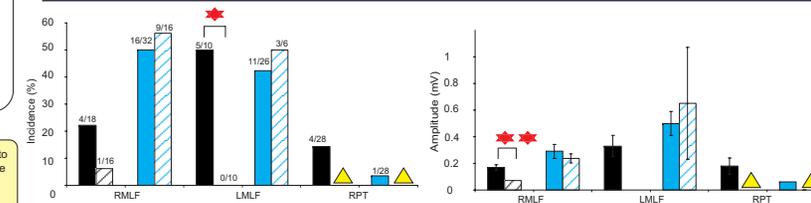
Examples of disynaptic EPSPs recorded from three different motoneurons. Responses to 1 shock (top) and 3 shocks (bottom) 300µA to RMLF (left), LMLF (middle) and RPT (right). MNA (Median Nerve at the Arm) projects to forearm flexors; DRN (Deep Radial Nerve) to forearm extensors; MNW (Median Nerve at the Wrist) to intrinsic hand muscles. Red: superimposed antidromic activation from the stimulated nerves. Black: intracellular recording. Blue: corresponding epidural volley. Segmental latencies were measured from the first inflection of the corresponding epidural volley (vertical green dashed line) to the onset of the postsynaptic response (vertical green solid line). EPSP amplitudes were measured from the response to the last of the three shocks.

## Population data

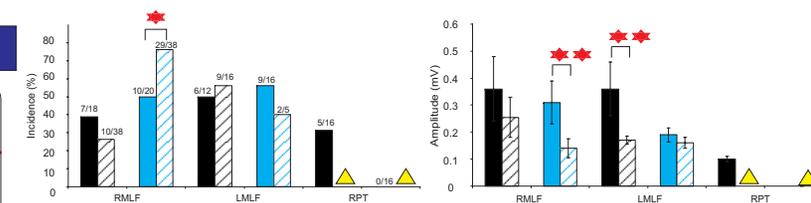
### Forearm Flexors



### Forearm Extensors



### Intrinsic Hand



- Monosynaptic from lesion monkeys
- Disynaptic from lesion monkeys
- Monosynaptic from control monkeys
- Disynaptic from control monkeys
- Significant difference (P<0.05)
- Significant difference (P<0.01)
- Control data for the RPT is currently being analysed

Population data. Histograms of incidence (left) and mean amplitude (right) of monosynaptic EPSPs (black) and disynaptic (blue) from the intact PT (RPT), and right and left MLFs. The numbers above each column in the incidence plots give the raw numbers of motoneurons. Error bars in amplitude plots are SEM. Amplitudes of disynaptic EPSPs were measured from the response to the last of a train of three or four shocks. Amplitudes of monosynaptic EPSPs were measured from the response to one shock from RMLF and LMLF, and the last of a train of three or four shocks from the RPT. Amplitudes (t test) and incidences ( $\chi^2$  test) of EPSPs in lesion monkeys (solid) were compared with control data (hatched lines) (for the RMLF: Riddle et al. 2009; for the LMLF: Soteropoulos et al manuscript in progress).

## Discussion

Our results support the concept that strengthening of reticulospinal connections may contribute to functional recovery following corticospinal tract lesion.

## Reference

Riddle CN, Edgley SA, and Baker SN. Direct and indirect connections with upper limb motoneurons from the primate reticulospinal tract. *J Neurosci* 29: 4993-4999, 2009.