

Role of the primary motor cortex (M1) in the control of fine manual dexterity of the homolateral hand as assessed in a model of unilateral lesion of M1 in macaque monkeys.



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OBJECTIVE

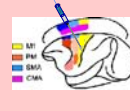
The role of the primary motor cortex (M1) in the control of the homolateral hand is still a matter of debate. The goal of this study was to investigate the effect of unilateral primary motor cortex (M1) lesion on the ipsilesional hand in non-human primates (Macaca fascicularis), using sophisticated behavioral tests of manual dexterity. The effect of the lesion of M1 was assessed at short-term as well as at long-term.

METHODS

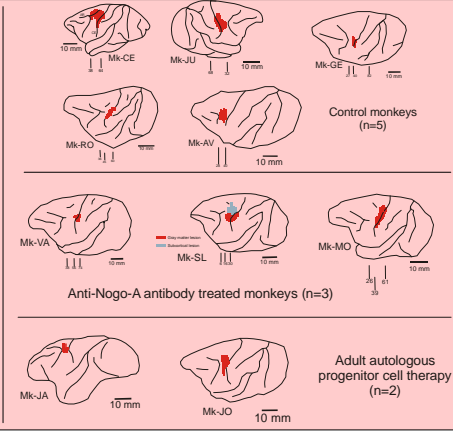
Experiments were conducted on **10** adult macaque monkeys trained to perform various manual dexterity tasks, including the “modified Brinkman board”, requiring precision grip. The monkeys were then subjected to a unilateral permanent lesion of the hand representation in M1. Monkeys’ behavioral performance was measured for each hand, before and after the lesion, until the recovery (complete or incomplete) of the contralesional hand reached a plateau and was pursued later on during several weeks. Initially, after the monkeys had reached a behavioral plateau, a lesion of the hand representation’s area (fingers) was performed unilaterally in M1 by infusion of ibotenic acid.



“modified Brinkman board” task



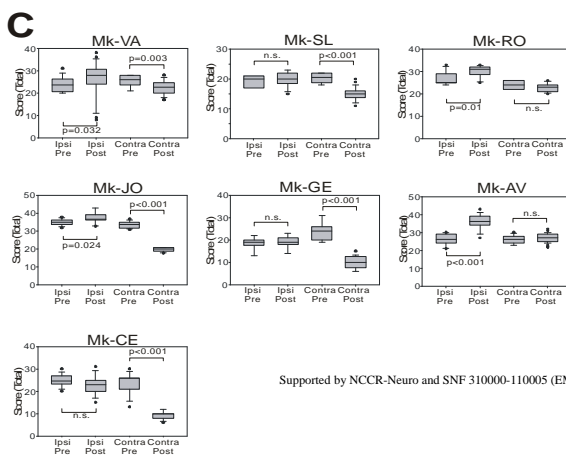
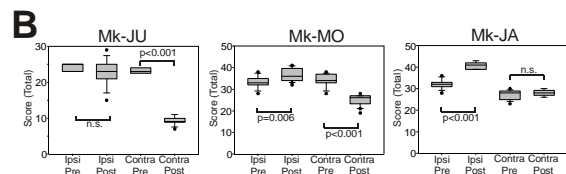
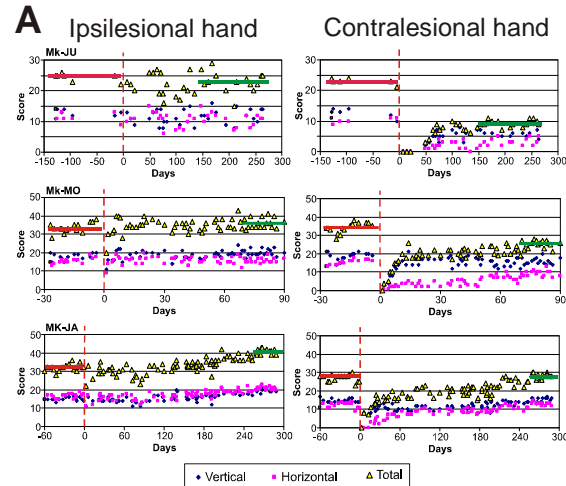
M1 lesion as seen in SMI-32 material for Mk-VA



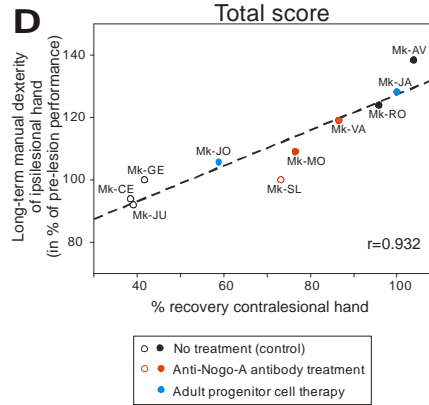
RESULTS

The subjects were 10 adult monkeys (Mk): 5 control monkeys, 3 anti-Nogo-A antibody treated monkeys and 2 monkeys subjected to cell therapy

1. Long-term effects



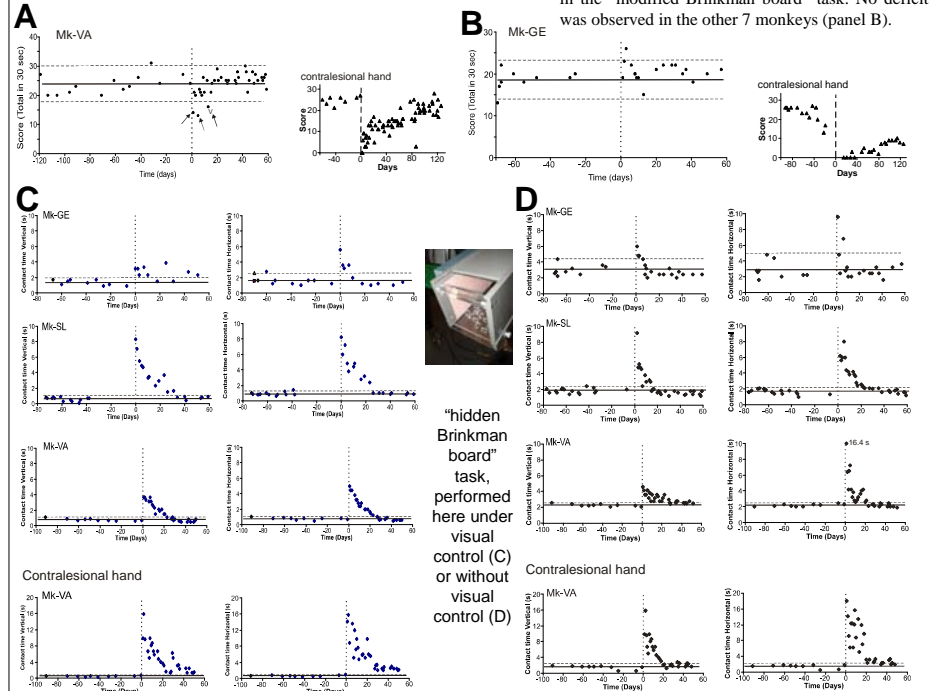
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The manual dexterity was assessed by the score (nb. of pellets retrieved in 30 seconds from the slots in the modified Brinkman board task (A-C)). Note, as expected, the deficit immediately after the lesion for the contralesional hand but not for the ipsilesional hand (A; see however below). The long-term recovery for the contralesional hand was quite variable across monkeys whereas, surprisingly, for the ipsilesional hand the manual dexterity was enhanced on the long-term in some monkeys, as compared to pre-lesion values (A, B and C). Such long-term enhancement of manual dexterity for the ipsilesional hand appeared to be correlated with good functional recovery of the contralesional hand (D).

2. Short-term effects

Only 3 monkeys (see panel A) out of ten exhibited a modest and transient deficit of the ipsilesional hand in the “modified Brinkman board” task. No deficit was observed in the other 7 monkeys (panel B).



For a more challenging motor task (“hidden Brinkman board”), the deficit of the ipsilesional hand was more prominent, lasting from 10 to about 30 days, before complete recovery (in contrast to the contralesional hand).

CONCLUSION

The degree of functional recovery of the contralesional hand covariates with the long-term performance of the ipsilesional hand. A better recovery was associated to a long-term enhanced manual performance of the ipsilesional hand. On the short-term, unilateral M1 lesion induced only a moderate and transient deficit of the ipsilesional hand, to an extent depending on the difficulty of the manual dexterity task.