Effects of unilateral lesion of the primary motor cortex on ipsilesional hand dexterity in adult monkeys.

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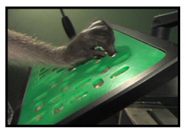
OBJECTIVE

The effects of unilateral lesion of the primary motor cortex (Ml) on ipsilateral hand dexterity remain controversial. The goal of this study was to re-examine the effect of M1 lesion on the **ipsilesional** hand in non-human primates (Macaca fascicularis), using sophisticated behavioral tests of manual dexterity.

METHODS

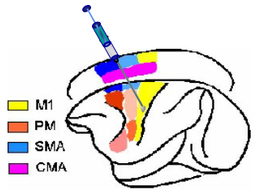
Experiments were conducted on **10** adult macaque monkeys trained to perform various manual dexterity tasks, including the "Standard Brinkman Board" Task, requiring precision grip. The "Reach and Grasp Drawer" task was tested in one monkey (MK-M). The monkeys were then subjected to a unilateral permanent 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.

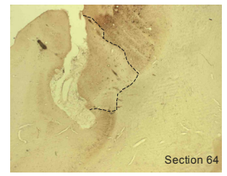


"Standard Brinkman Board" task

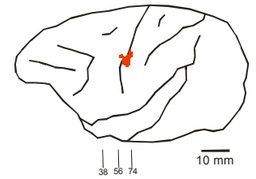
"Reach and Grasp Drawer" task

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.





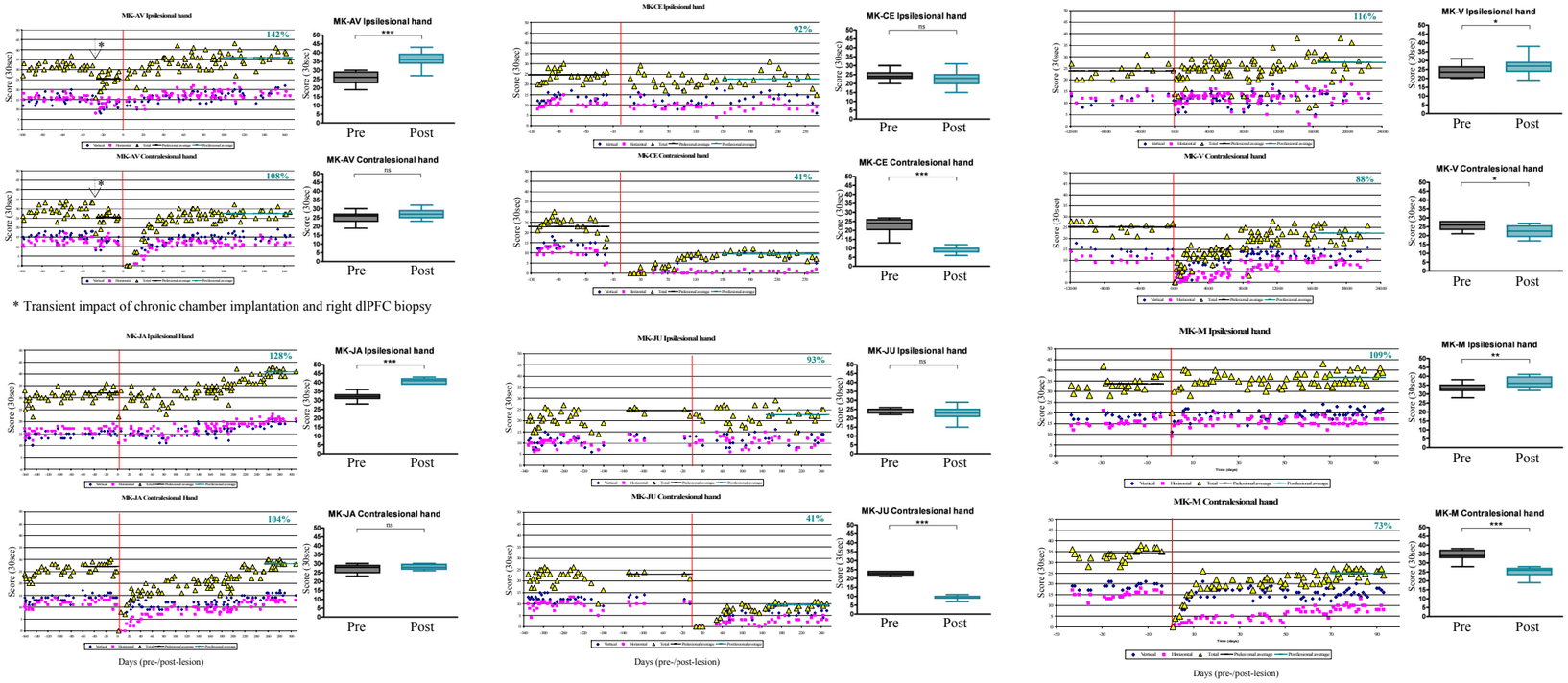
M1 lesion as seen in SMI-32 material for MK-V



Reconstruction of M1 lesion (red area) as seen on a lateral view of the left hemisphere for MK-V

RESULTS

Standard Brinkman Board



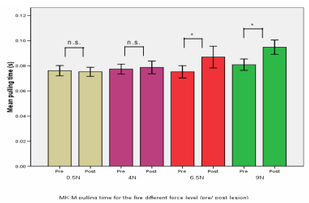
* Transient impact of chronic chamber implantation and right dlPFC biopsy

We measured the number of pellets retrieved during the first 30 seconds. For each monkey, after M1 lesion, the contralesional hand's dexterity was dramatically reduced, as expected. Then, a progressive recovery took place, which was different across monkeys, sometimes complete, sometimes incomplete, depending on the lesion size, lesion position and treatments applied to some monkeys.

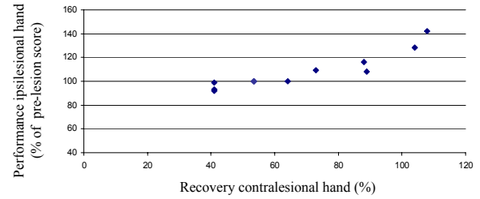
Concerning the effect of M1 lesion on the **ipsilesional** hand, there was a very light and transient effect in the acute phase in MK-JA and MK-M, but not in the other monkeys (Standard Brinkman Board task).

More interestingly, several weeks/months post-lesion, there was a progressive, highly significant enhancement of the **ipsilesional** hand's performance in the monkeys which recovered completely with the contralesional hand (MK-AV, MK-JA). This **ipsilesional** hand effect was less prominent in monkeys with incomplete (about 50-90%) recovery of the contralesional hand. On the other hand, when the recovery of the contralesional hand was poor (about 40%), then the ipsilesional hand did not show any enhancement of performance, a situation usually observed in monkeys subjected to a large M1 lesion (MK-CE, MK-JU).

Drawer Task



MK-M showed a deficit for the **ipsilesional** hand in the Drawer Task (increase of pulling time).



Relationship between the extent of functional recovery of the contralesional hand and the enhancement of **ipsilesional** hand performance post-lesion.

CONCLUSION

Following unilateral lesion of M1 in adult monkeys, the deficits of the **ipsilesional** hand are subtle and short-time lasting in some monkeys or absent in other monkeys. When the functional recovery of the contralesional hand is complete or extensive, the **ipsilesional** hand exhibits an enhanced performance as compared to pre-lesion. In contrast, such effect on the **ipsilesional** hand is absent when the functional recovery of the contralesional hand is poor.

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