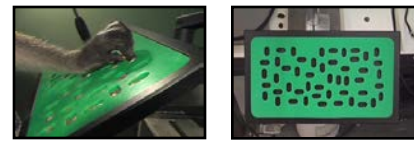


## OBJECTIVE

The effects of unilateral lesion of the primary motor cortex (M1) on ipsilateral hand dexterity remain controversial. The goal of this study was to re-examine the effects 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 **11** adult macaque monkeys trained to perform various manual dexterity tasks, including the “Modified Brinkman Board” and the “Brinkman box” tasks, 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.

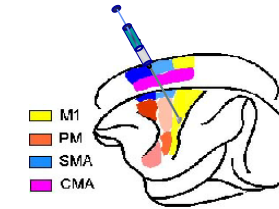


“Modified Brinkman Board” task

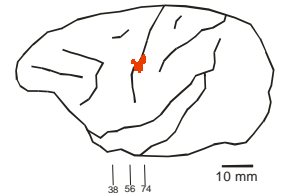


“Brinkman Box” task

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-VA



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

## RESULTS

Fig. 1

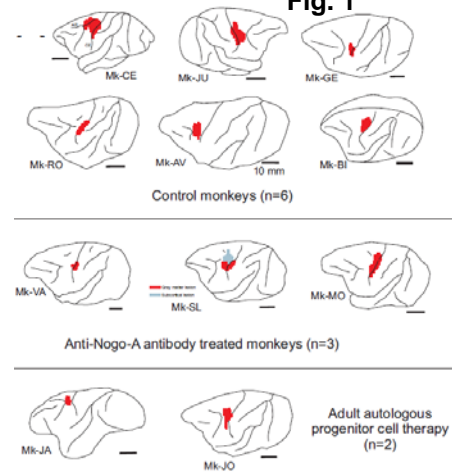


Fig. 3

Modified Brinkman board (contact time, 5 pellets) Ipsilesional hand

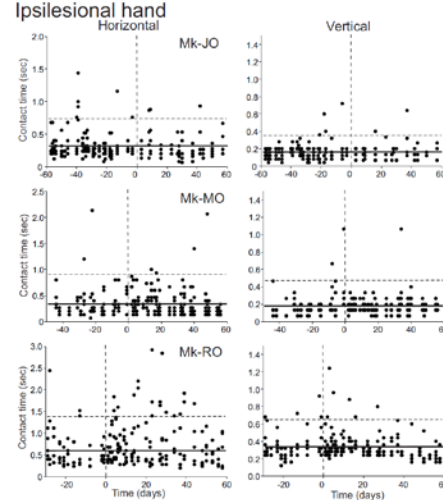
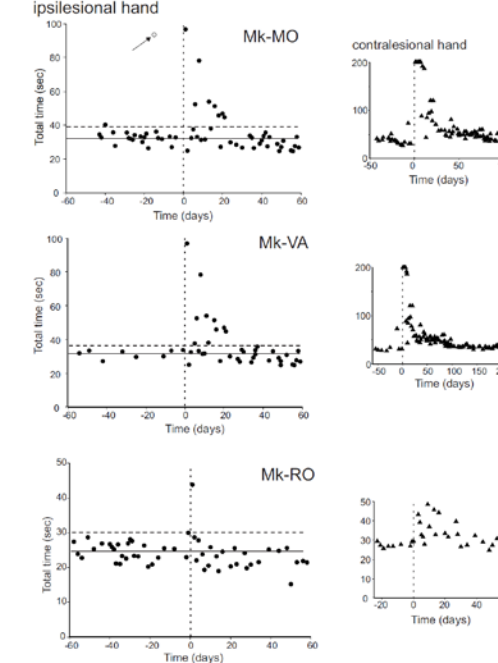


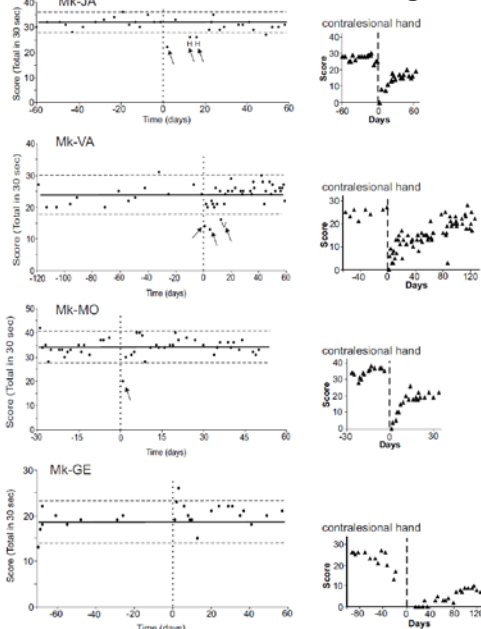
Fig. 4

Brinkman box with visual control (total time) ipsilesional hand



Modified Brinkman board (retrieval score) Ipsilesional hand

Fig. 2



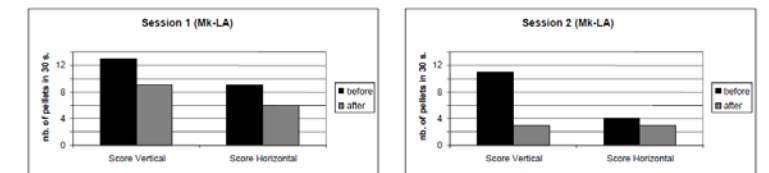
The lesion of M1 was reconstructed for each monkey on a lateral view of the corresponding hemisphere (Fig. 1).

In the **Modified Brinkman board** task, we measured for each hand the number of pellets retrieved during the first 30 seconds (**retrieval score**; Fig. 2), as well as the time of contact between the fingers and the pellets before successful grasping (**contact time**; Fig. 3).

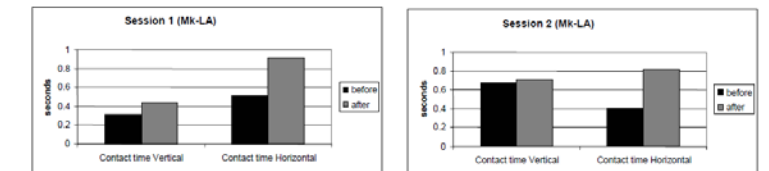
In the **Brinkman box** task, we measured for each hand the total time needed by the monkey to empty the 20 slots of the box (**total time**; Fig. 4).

Fig. 5

A. Effect of muscimol inactivation on retrieval score (Modified Brinkman board task)



B. Effect of muscimol inactivation on contact time (Modified Brinkman board task)



In an additional monkey (Mk-LA, intact), M1 was reversibly inactivated unilaterally by infusion of muscimol in 2 separate sessions. As expected, there was a complete paralysis of the contralesional hand (not shown). The graphs show the deficits in manual dexterity for the **ipsilesional** hand (retrieval score and contact time), which are consistent with the data in Figs. 1-4.

## CONCLUSION

Following unilateral lesion of M1 in adult monkeys, in contrast to the devastating and long lasting effect on the contralesional hand, the deficits for the **ipsilesional** hand are subtle and short-time lasting in some monkeys or absent in other monkeys. It follows that the neuronal activities observed in M1 in monkeys performing ipsilateral hand movements (e.g. Chen et al. 1991; Donchin et al. 1998, 2002; Kermadi et al. 1998, 2000; Kazennikov et al. 1999; Cisek et al. 2003) are most likely related to activation of more proximal muscles (for postural adjustments) and/or activities aimed at preventing simultaneous movements of the opposite hand.

	Mk-CE	Mk-JU	Mk-GE	Mk-RO	Mk-AV	Mk-BI	Mk-VA	Mk-SL	Mk-MO	Mk-JA	Mk-JO
Retrieval score	N	N	N	N	N	Y	Y	N	Y	Y	N
Contact time	N	N	Y	Y	N	N	N	Y	N	N	N
Total time	-	-	N	N	N	N	Y	Y	Y	N	N

Summary of data for the 11 monkeys subjected to permanent unilateral lesion of M1 (hand area): deficits in manual dexterity for the ipsilesional hand are indicated by “Y” (“N” is for no deficit).