

Changes of motor strategies following a right dorsolateral prefrontal cortical biopsy in macaque monkeys.

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INTRODUCTION

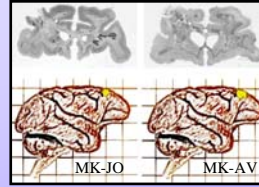
For the needs of a larger study (autotransplantation of adult brain cells in a model of M1 lesion), a unilateral biopsy of cortical tissue was performed surgically on the right dorsolateral prefrontal cortex (dlPFC) of two adult macaque monkeys (MK-JO and MK-AV).

As different studies have shown a clear implication of dlPFC in different cognitive functions, especially spatial working memory and decision making, we could expect a possible effect of right dlPFC biopsy on the performance of monkeys engaged in a sequence of voluntary movements.

We hypothesized that dlPFC lesion had no effect on motor control *per se* but may affect the motor strategy.

METHODS

The monkeys were anaesthetized under sterile surgical conditions. A square osseous sector was opened above the dlPFC. Then, an approximate volume of 8 mm³ cortical tissue was extracted using a surgical blade.

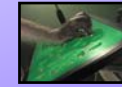


During the same operation, an electrophysiological recording chamber was implanted on the skull above M1 in the opposite hemisphere. Two additional monkeys (MK-V and MK-S) subjected to the same chamber implantation but without biopsy were used as controls.

Monkeys were initially trained to perform two unimanual prehension tasks requiring precision grip.

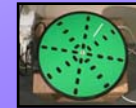
Standard (static) Brinkman Board

It contains 25 vertically and 25 horizontally oriented and randomly distributed wells, which were numerated.



Rotating Brinkman Board

It contains 32 wells, with orientations corresponding to vertical and horizontal positions when the wells are in front of the monkey, and organized in four rings numerated from the most external to the most internal ring.

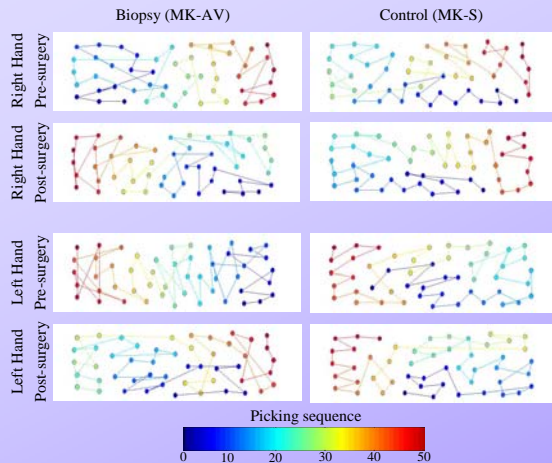


○ Ring 1
 ○ Ring 2
 ○ Ring 3
 ○ Ring 4

RESULTS

Following the dlPFC biopsy, the monkeys showed, in both tasks and for each hand, a dramatic change in terms of picking sequence, as compared to control monkeys.

Standard (static) Brinkman Board
 Representative sessions



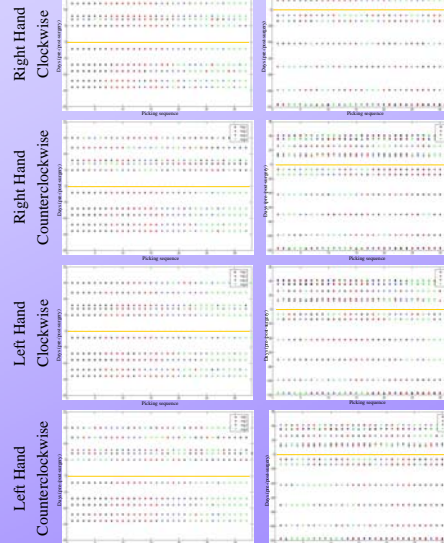
For the Standard Brinkman Board task, before biopsy, the monkey picked the pellets in a left/right axis organized sequence (left to right with his right hand and right to left with his left hand). After biopsy, an inversion of the picking sequence on this left/right axis occurred, for both hands (right to left with his right hand and left to right with his left hand).

Rotating Brinkman Board

Biopsy (MK-AV)

Control (MK-S)

Time of surgery

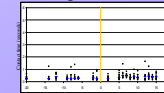


Interestingly, the stronger effect in the Rotating Brinkman Board task occurred when the rotation was counterclockwise, for both hands. Indeed, we could observe that before biopsy, the monkey picked the pellets in an organized sequence ranging from ring 1 to ring 4 whereas, after biopsy, he picked them in a more random way.

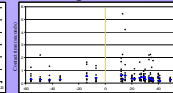
Note that control monkey's picking sequence was less strictly organized before chamber implantation. Nevertheless, there is a light effect of chamber implantation on this task.

Standard (static) Brinkman Board

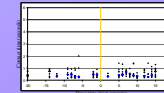
Biopsy (MK-AV)
 Right Hand



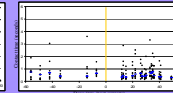
Control (MK-S)
 Right Hand



Biopsy (MK-AV)
 Left Hand



Control (MK-S)
 Left Hand



In terms of contact time to retrieve a pellet, reflecting intrinsic hand motor control, no substantial difference was found pre-versus post-dlPFC biopsy as compared to pre- versus post-chamber implantation.

DISCUSSION

Sampling cortical tissue, although medically considered as situated in a non-eloquent brain area, is not harmless and each potential consequence should be carefully considered.

Indeed, this kind of motor tasks -never used before to evaluate the impact of a dlPFC lesion-, was affected by a right dlPFC biopsy, irrespective of the hand used to grasp the pellets.

These data, showing a change of prehension's strategy following a right dlPFC biopsy, are in line with previous studies having proposed a specialization of the dlPFC for visuospatial working memory and decision making.



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