

1

2

3

가

1.5T

(EPI)

Paradigm

가

(A),

(B).

Stimulate 5.0 (University of Minnesota, John P. Strupp)

200,

0.3,

가

1.0,

0.3,

3

A, B

가

t-test

가

: A, B 9

A 31.6 , B 27.8

(P>0.1).

A 7 , B 4

A 14.9 , B 18

A 8

17.5

3

10

가

가

(Functional Magnetic Resonance
(brain mapping)

(cognitive func-

bin) 가

(1-3).

(oxyhemoglo-

가

(Echo Planar

(Blood Oxygen Level

가

가

가

가

(time- signal

intensity curve)

1998 11 30

1999 4 2

1019

가

가 가

가

가 가

21 40 (27.3) 9

가 7 , 가 2 . 1.5T

(Vision, Siemens, Germany)

(head coil)

(noise) (artifact)

(foam pad)

(headphone)

A

가 (motor

cortex)

(maximum internal word

generation)

(Fig.1A). B

(motor speech area)

(Fig.1B).

T2 (TR/TE 0.8/40ms, flip angle 90°, matrix size 64 × 64, slice thickness 4mm, FOV 220 × 220mm)

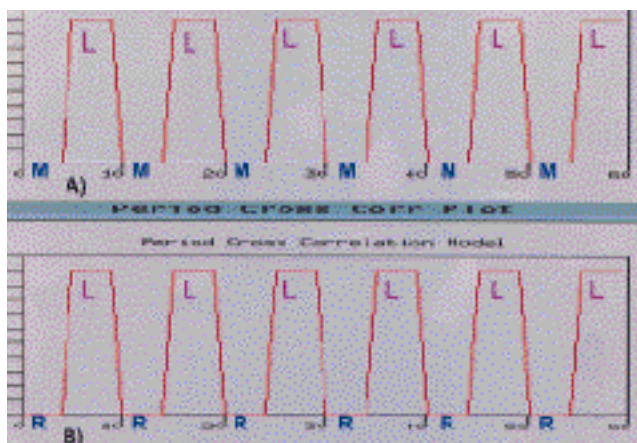


Fig. 1. Reference curve and alternative task in group A(A) and group B(B).
A. Motor stimulation during resting period.
B. No motor stimulation during resting period. L ; maximum internal word generation M ; flexion of five fingers R ; rest.

T1 (TR/TE 500/ 14ms, flip angle 70°, matrix size 256 × 256, slice thickness 4mm, FOV 220 × 220mm)

5

6 60

(scan) 16

(scan time) 2

T1 120 가

2 220

340

Stimulate 5.0 (University of Minnesota, John P. Strupp)

(signal intensity) (refer-

ence curve, Fig. 1) (cross-

correlation)

(positive correlation)

(negative correlation)

(Fig. 2).

(background

threshold) 200, (correlation threshold) 0.3

(ceiling) (floor)

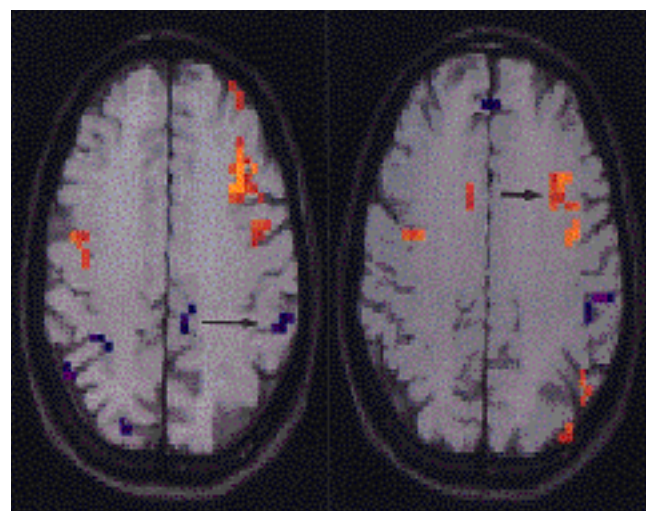


Fig. 2. Functional MR imaging of the Broca's area and the primary motor area, with positive(thick arrow) and negative correlation(thin arrow).

1.0 0.3 , (activated pixel) 3

가 A 7 , B 4
A 14.9 , B 18.0

(Table 1).

가
t-test

A 8

가 ,
17.5 가

A, B 9 (Broca's area)

3

가 (Fig. 3).

6

A

, 3

B

,

A

31.6

, B 27.8

A

(Fig. 4).

가

(4,5).

Table 1. Number of Activated Pixels in Group A and B.

Case No.	Age/Sex	Motor Speech Area			
		Left		Right	
		group A	group B	group A	group B
1	30/M	11	6	0	0
2	34/M	71	37	27	17
3	33/M	44	34	36	40
4	31/M	70	60	8	0
5	34/M	25	17	7	3
6	40/M	39	16	16	0
7	29/M	8	43	7	12
8	21/F	6	21	3	0
9	24/F	11	16	0	0
Average		31.6	27.8	14.9	18.0
P-value		0.7109		0.5707	

group A ; Motor activation during resting period

group B ; No motor activation during resting period

(6-8).

가

가

가

(9-19).

(inferolateral frontal cortex)

(Brodmann area) 44,45

46,47

(20-22).

(Wernicke's area)

(angular gyrus),

(basal ganglia),

(pulvinar)

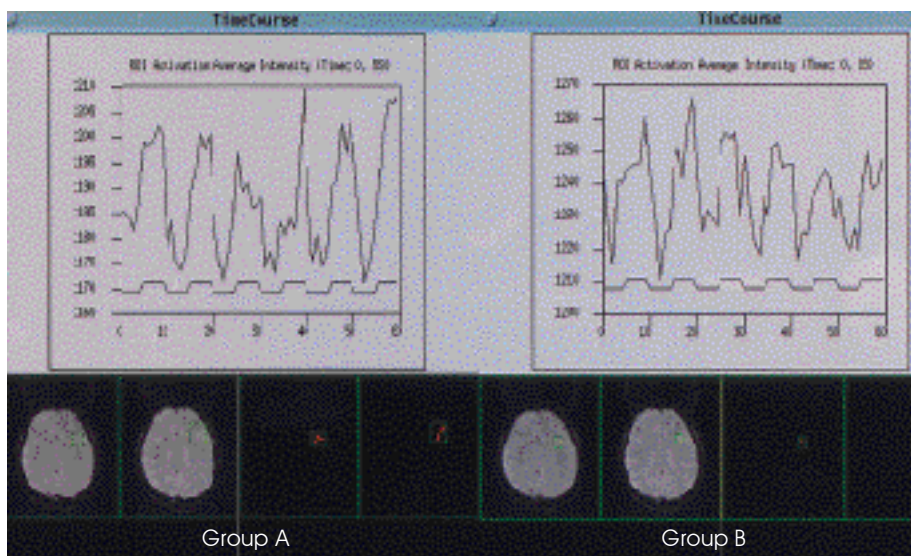


Fig. 3. Time-course plots and positive correlation. In group A and B, average time-course plots in the Broca's area show a good positive correlation with the reference curve.

:
 (lateral corticospinal tract)
 (rubrospinal tract) (28,29).
 6 10, 12 (12,23).
 가 9 8 ,
 (Positron Emission Tomography) (20,21)
 가 ,
 가
 가
 (dominant hemisphere)
 가 (24-27).
 가 7 가 4 ,
 가
 가
 4
 (primary motor cortex) 6
 (supplementary motor cortex) ,
 (parietal lobe), (thalamus), (cerebellum),
 (brain stem) ,

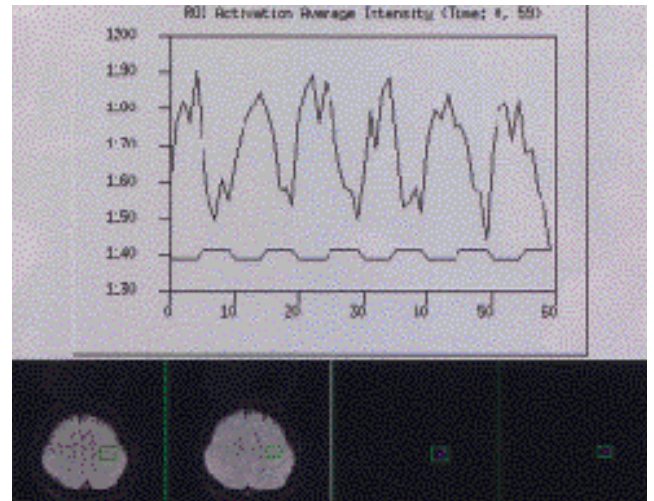
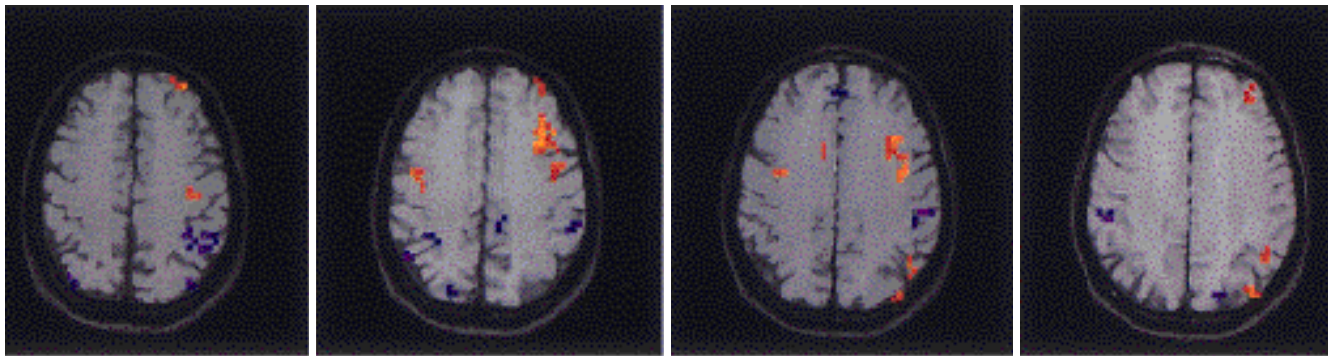
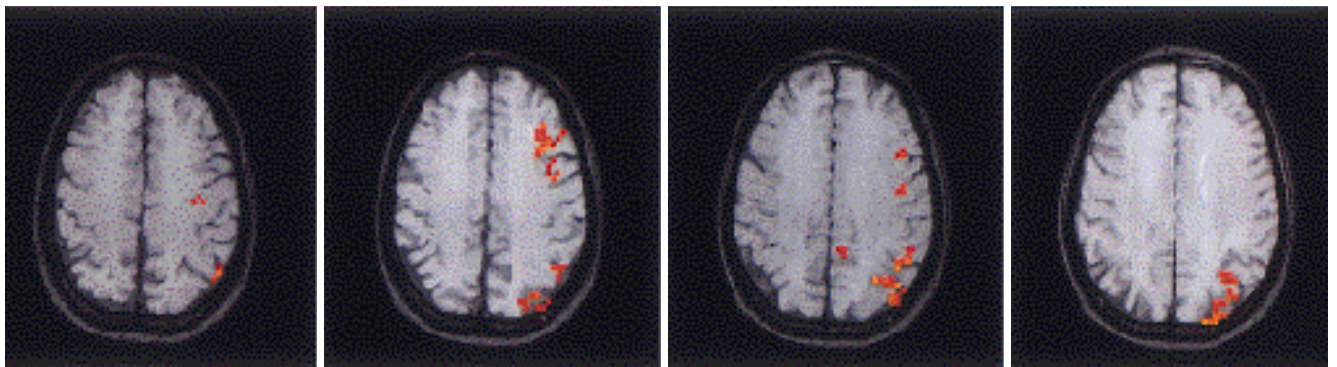


Fig. 5. Time-course plot and positive correlation. In group A, average time course plots in the primary motor area show a good negative correlation with the reference curve.



Group A



Group B

Fig. 4. Positive correlation in Broca's area. The number of activated pixels in group A were more than in group B.

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Functional MRI of Motor Speech Area Combined with Motor Stimulation during Resting Period¹

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Purpose : To evaluate functional MR imaging of the motor speech area with and without motor stimulation during the rest period.

Materials and Methods : Nine healthy, right-handed volunteers(M:F= 7:2, age:21-40years) were included in this study. Brain activity was mapped using a multislice, gradient echo single shot EPI on a 1.5T MR scanner. The paradigm consisted on a series of alternating rest and activation tasks, performed six times. Each volunteer in the first study(group A) was given examples of motor stimulation during the rest period, while each in the second study(group B) was not given examples of a rest period. Motor stimulation in group A was achieved by continuously flexing five fingers of the right hand. In both groups, maximum internal word generation was achieved during the activation period. Using fMRI analysis software(Stimulate 5.0) and a cross-correlation method(background threshold, 200; correlation threshold, 0.3; ceiling, 1.0; floor, 0.3; minimal count, 3), functional images were analysed. After correlating the activated foci and a time-signal intensity curve, the activated brain cortex and number of pixels were analysed and compared between the two tasks. The t-test was used for statistical analysis.

Result : In all nine subjects in group A and B, activation was observed in and adjacent to the left Broca's area. The mean number of activated pixels was 31.6 in group A and 27.8 in group B, a difference which was not statistically significant($P > 0.1$). Activities in and adjacent to the right Broca's area were seen in seven of group A and four of group B. The mean number of activated pixels was 14.9 in group A and 18 in group B. Eight of nine volunteers in group A showed activity in the left primary motor area with negative correlation to the time-signal intensity curve. The mean number of activated pixels for this group was 17.5. In three volunteers, activation in the right primary motor area was also observed, the mean number of activated pixels in these cases was 10.0.

Conclusion : During the rest period, functional MR imaging of the motor speech center combined with motor stimulation was more effective than that without stimulation, and simultaneously provided mapping of the primary motor area.

Index words : Magnetic resonance(MR), motion studies
Brain, MR

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