MP34-17: Assessment of Mental Imagery by Neuroimaging for surgical Development: The MIND Trial

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BACKGROUND

- Motor imagery (MI) has been effective in technical skills training across various disciplines including surgery, elite sports and rehabilitation medicine
- Studies have demonstrated that MI can alter motor network connectivity albeit with simple motor tasks[1]
- Todate the evaluation of MI for surgical tasks has been limited to questionnaires[2]
- Resting state functional connectivity (rsFC) using fMRI allows the evaluation of complex motor training effects[3]

OBJECTIVES

To evaluate the effects of MI training for a complex surgical task on resting state functional connectivity

MATERIALS & METHODS

1. Four intermediate skill surgeons were recruited following informed consent
   - Ethics approval HR-18/19-7926
2. Each subject underwent
   - Baseline fMRI protocol consisting of resting state imaging and a regions-of-interest (ROI) motor localisation task
   - Baseline dry-lab laparoscopic skill assessment
3. All participants completed structured MI training using the validated PETTLEP model and a MI script
4. Participants performed self directed MI training at least once a day for a period of 14 days
5. After training, all participants underwent repeat fMR imaging and laparoscopic skills assessment

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RESULTS

fMRI Results

- Six ROIs were identified (Figure 1)
  - Functional connectivity analysis was obtained by using partial correlation between the average time courses of all possible pairs of the 6 ROIs
- Comparison of the rsFC before and after training demonstrated a significant increase in the connectivity between the contralateral prefrontal and the premotor and motor areas (Brodmann 4/6) (Figure 2)
- Connectivity between all other ROIs did not demonstrate significant change

Laparoscopic Training Results

- Technical skills evaluation was performed post-hoc by a blinded expert surgeon using GOALS and a Suturing Checklist
- Both GOALS and suturing checklist scores increased post training (p > 0.05) (Figure 3)

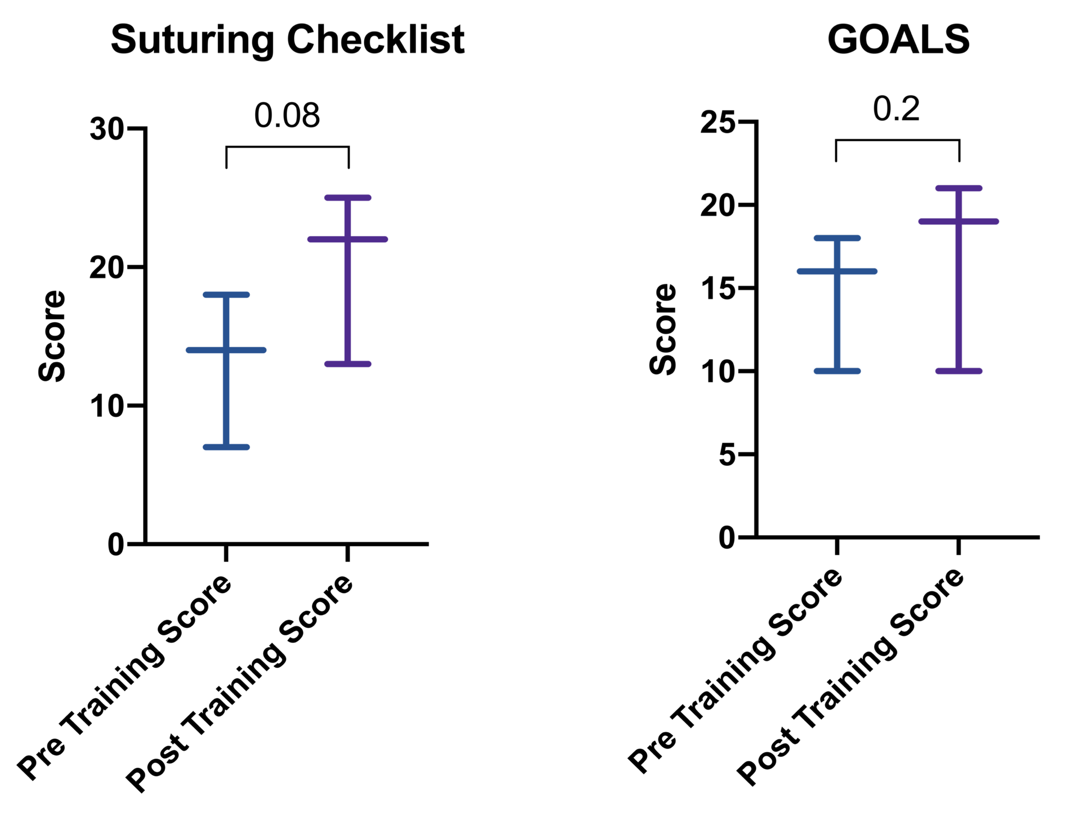

Figure 3. Comparison of laparoscopic suturing skill before and after MI training

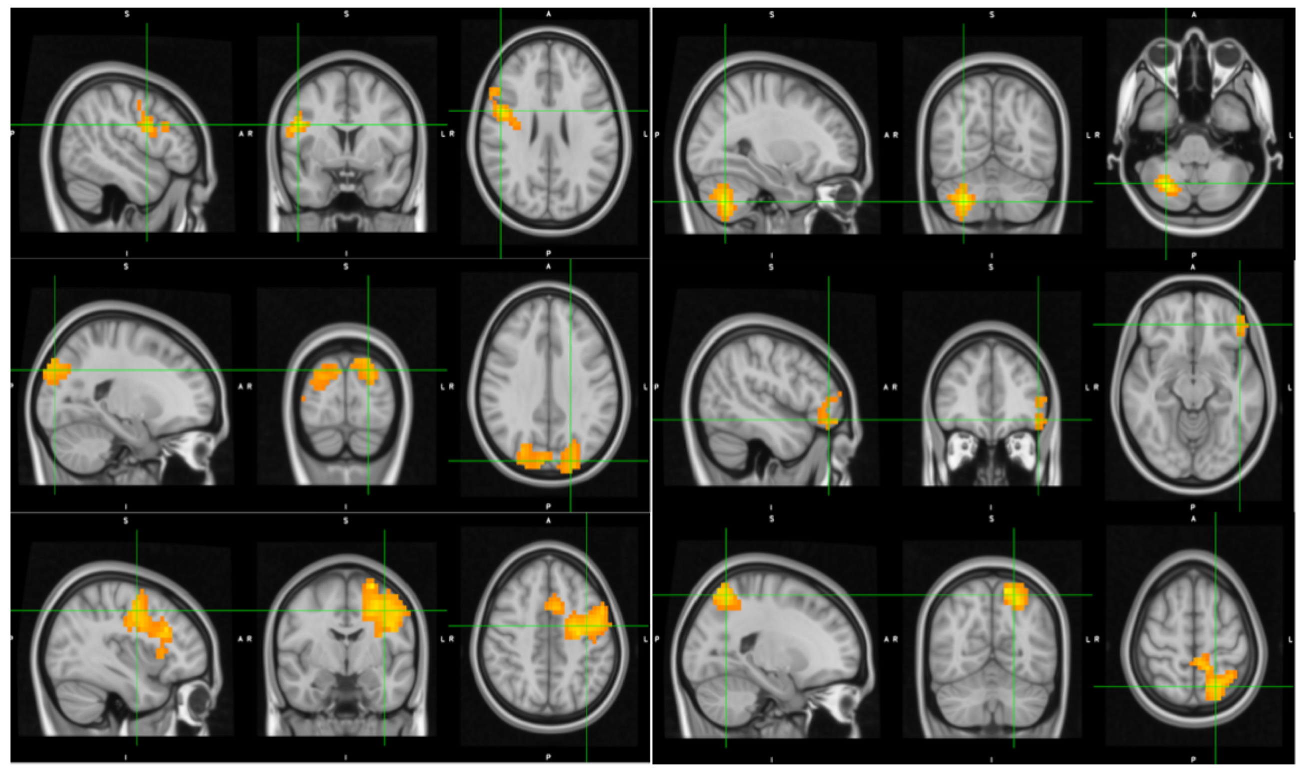

Figure 1. The 6 Regions-of-Interest identified through the motor localisation task

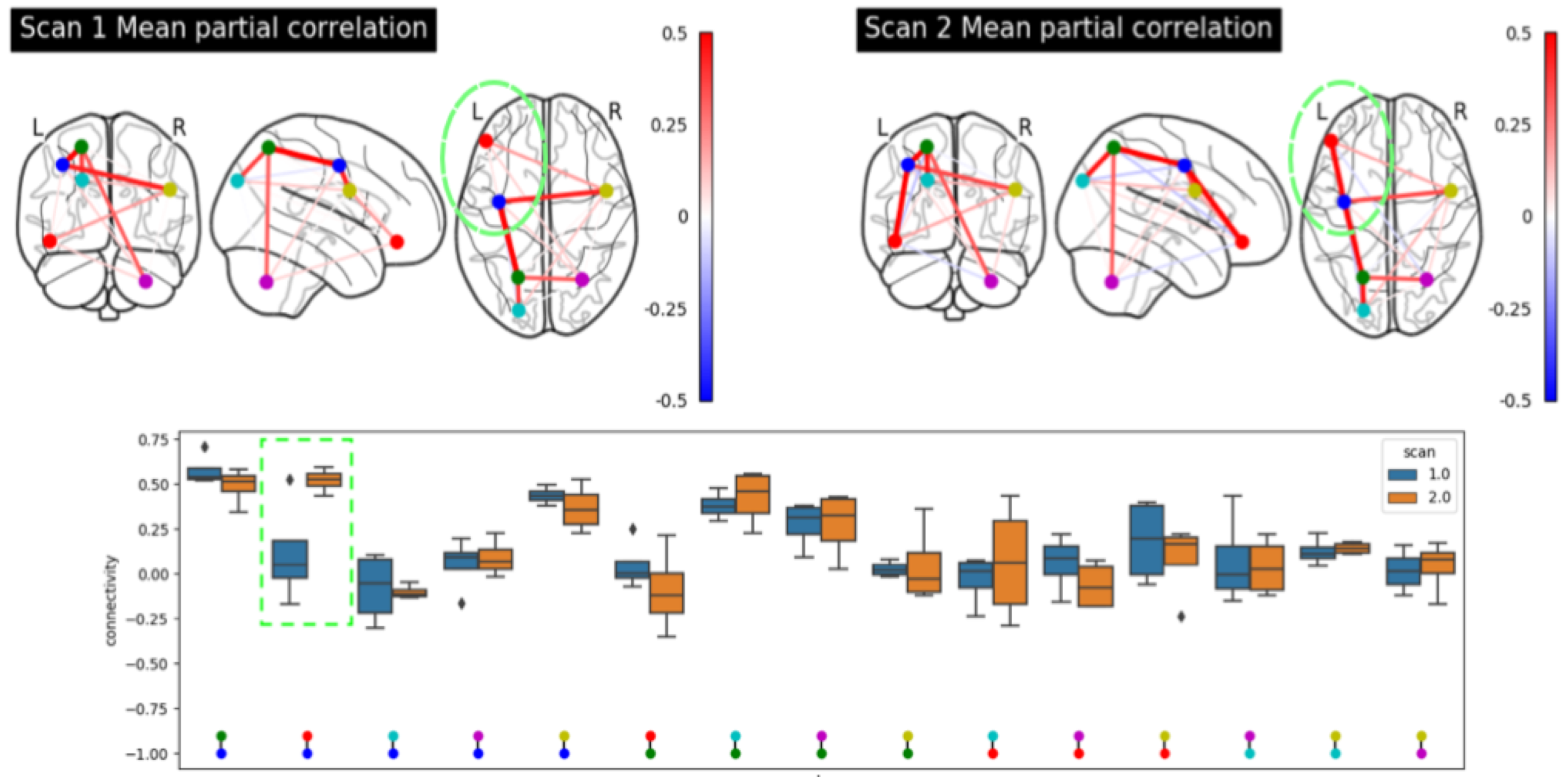

Figure 2. rsFC of the motor imagery task with mean partial correlation of ROIs before (Scan 1) and after (Scan 2) MI training (significant effect shown by green dashed box)

REFERENCES

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CONCLUSIONS

This study has shown that MI training for a surgical task results in measurable changes in rsFC alongside improvements in technical performance of the task. Specific changes in the functional connectivity between the frontal and motor cortices were seen. These results highlight the potential role of MI for surgical training and support further comparative trials.

Figure 5: Study Design