Assessment of **M**ental **I**magery by **N**euroimaging for surgical **D**evelopment: The MIND Trial

Nicholas Raison[1], Michael Hutel[2], Evaldo Favi[3], Kamran Ahmed[1], Sebastian Ourselin[2], Prokar Dasgupta[1]
[1]MRC Centre for Transplantation, King's College London, London, UK; [2]School of Biomedical Engineering & Imaging Sciences, King's College London, London, UK; [3]Department of Renal Transplantation, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

Brain Training?

Boot camp for your brain: Want to be happier, feel younger AND stave off dementia? Then try a leading neurosurgeon's brilliantly simple workouts for your little grey cells

Does brain training make you smart?

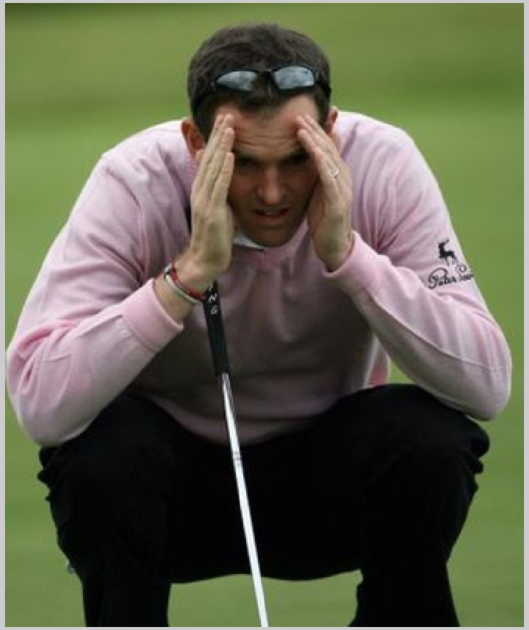
You can boost your brainpower, says Caroline Williams, but it's not as simple as just giving your head a work-out

Mind games: a mental workout to help keep your brain sharp

THINK TO SHRINK Weight loss: Brain training app helps shed pounds – slashing 200 calories per day

Mental Training in Elite Sports

- Reduce anxiety
- Enhance concentration
- Improve self-confidence
- **Support Technical Performance (Motor Imagery)**



Motor Imagery In Surgery?

J Surg Educ. 2012 Mar-Apr;69(2):190-5. doi: 10.1016/j.jsurg.2011.07.011. Epub 2011 Sep 3.

Learning basic laparoscopic skills: a randomized controlled study comparing box trainer, virtual reality simulator, and mental training.

Mulla M[1], Sharma D, Moghul M, Kailani O, Dockery J, Ayis S, Grange P.

Ann Surg. 2007 Mar;245(3):385-91.

Mental training in surgical education: a randomized controlled trial.

Immenroth M[1], Bürger T, Brenner J, Nagelschmidt M, Eberspächer H, Troidl H.

J Surg Educ. 2013 Jul-Aug;70(4):544-51. doi: 10.1016/j.jsurg.2013.04.003.

Using the mind as a simulator: a randomized controlled trial of mental training.

Eldred-Evans D[1], Grange P, Cheang A, Yamamoto H, Ayis S, Mulla M, Immenroth M, Sharma D, Reedy G.

Ann Surg. 2011 Feb;253(2):265-70. doi: 10.1097/SLA.0b013e318207a789.

Mental practice enhances surgical technical skills: a randomized controlled study.

Arora S[1], Aggarwal R, Sirimanna P, Moran A, Grantcharov T, Kneebone R, Sevdalis N, Darzi A.

BJU Int. 2018 Dec;122(6):1075-1081. doi: 10.1111/bju.14376. Epub 2018 Jun 12.

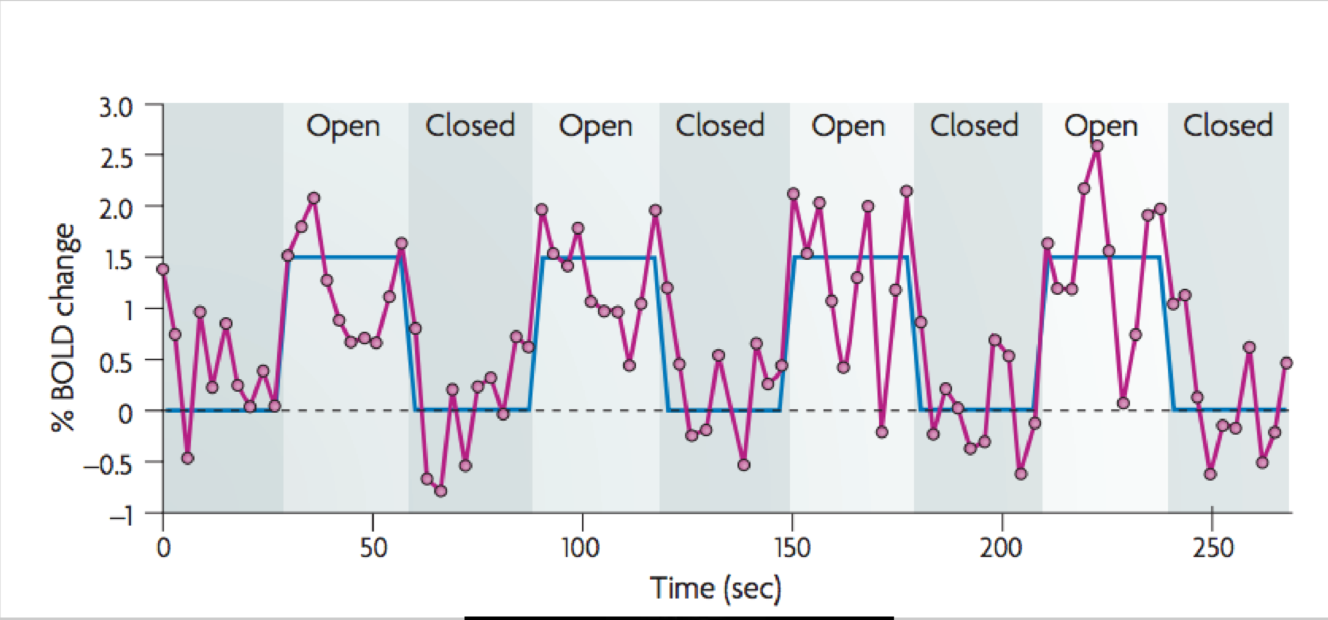
Cognitive training for technical and non-technical skills in robotic surgery: a randomised controlled trial.

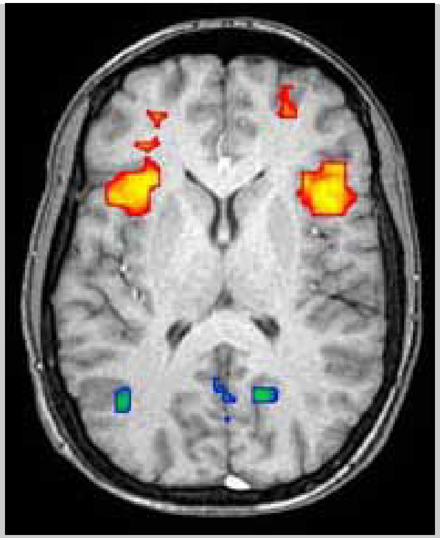
Raison N[1], Ahmed K[1], Abe T[1,2], Brunckhorst O[1], Novara G[3], Buffi N[4], McIlhenny C[5], van der Poel H[6], van Hemelrijck M[7], Gavazzi A[8], Dasgupta P[1].

Aims of the MIND Trial

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

Resting State Functional Connectivity





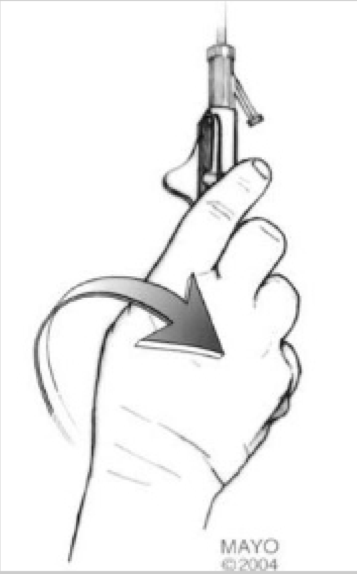
- Spontaneous BOLD signal in the absence of any explicit task or an input
- 60–80% of brain’s energy is consumed during resting state
- Correlation between spontaneous BOLD signals of brain regions functionally and/or structurally related
- Learning has been shown to result in relatively specific changes in resting state networks.

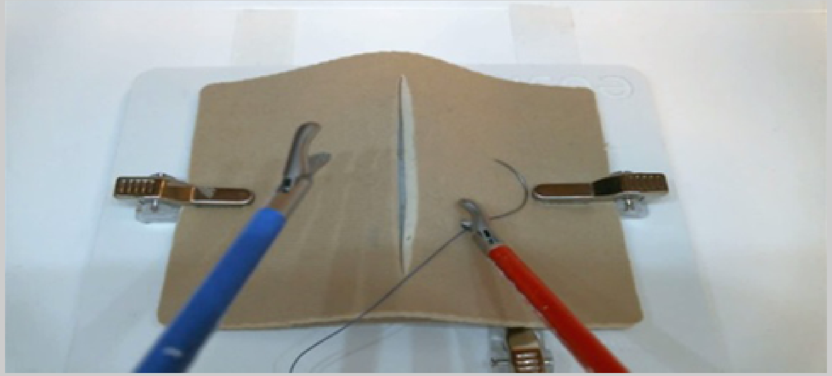
MIND Trial Methodology: 1

- 4 surgical trainees

- fMRI imaging protocol
  - Resting state scan
  - Regions-of-interest (ROI) localisation task

- Laparoscopic Skills Assessment
  - Performance video-recorded





MIND Trial Methodology : 2

- MI Training
  - PETTLEP Model
  - 2 weeks

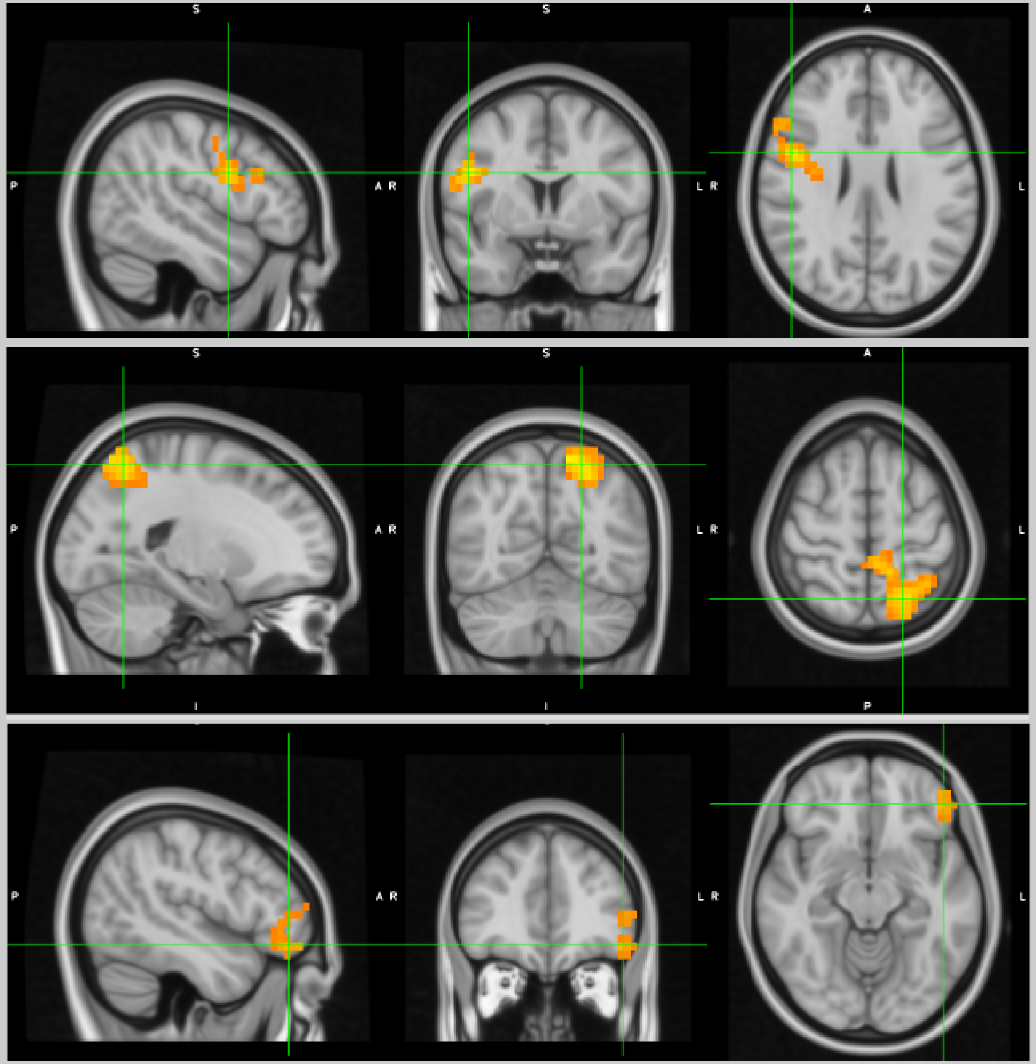
Firmly grasp the needle in the right needle driver – about 2/3 along from the tip. Feel the position of the needle in the needle holder and decide if it is at an appropriate angle to suture

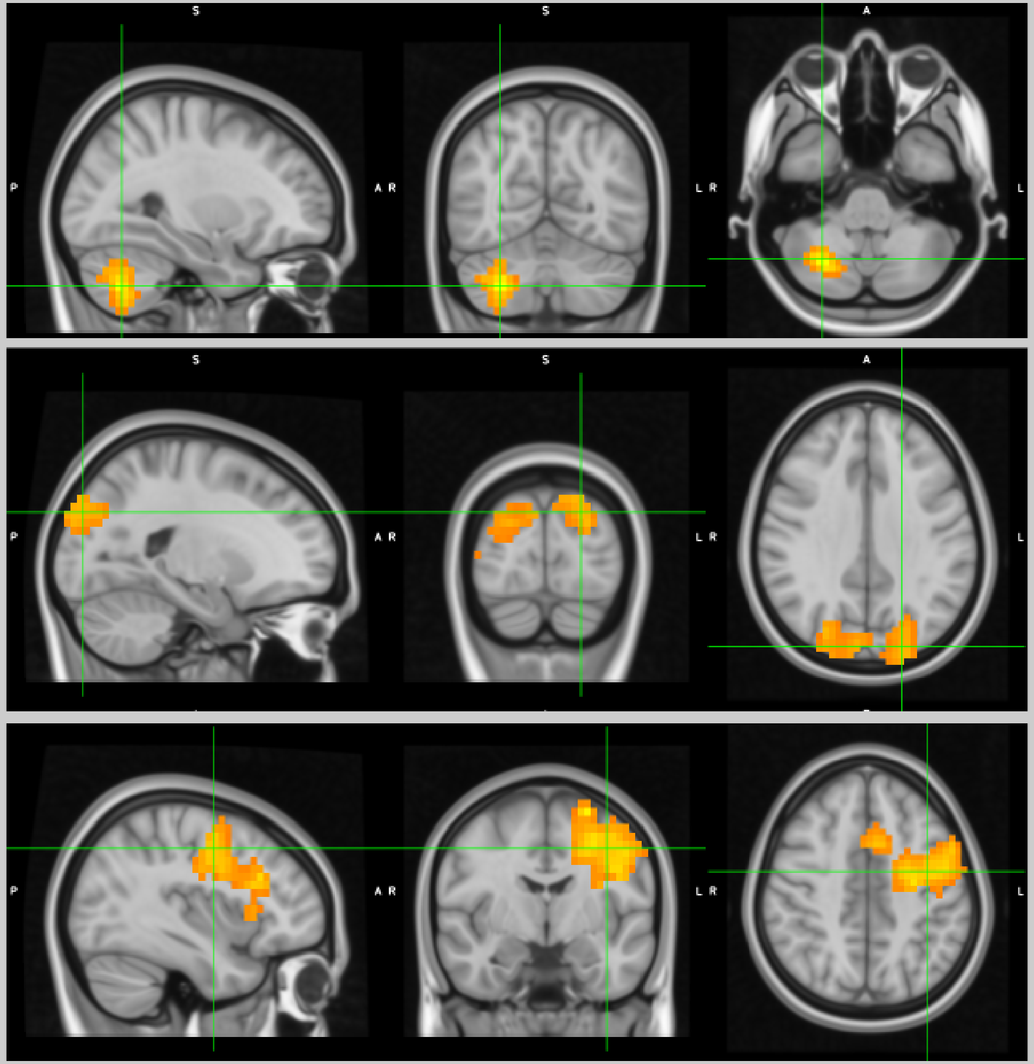
See the needle hub exit the tissue and then use your left needle driver to grasp the suture thread about 1cm from the hub

MIND Trial Methodology

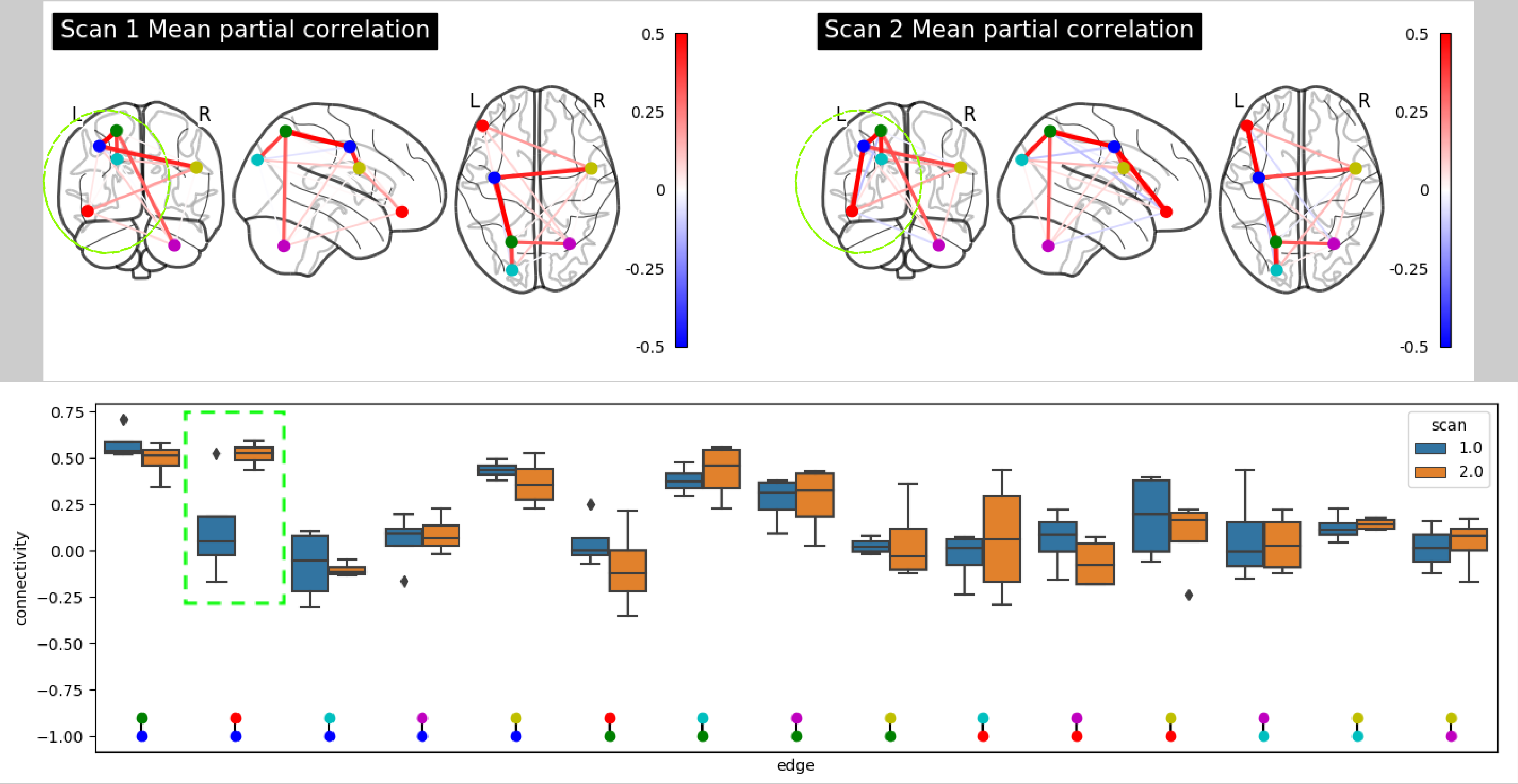
- Repeat fMRI Imaging
  - Identical protocol
- Repeat Laparoscopic Skills Assessment
  - Performances Video Recorded
  - Blinded Assessment by Expert Laparoscopic Surgeon
    - GOALS
    - Suture Specific Checklist (Moorthy et al, 2004)

Results: Regions of Interest

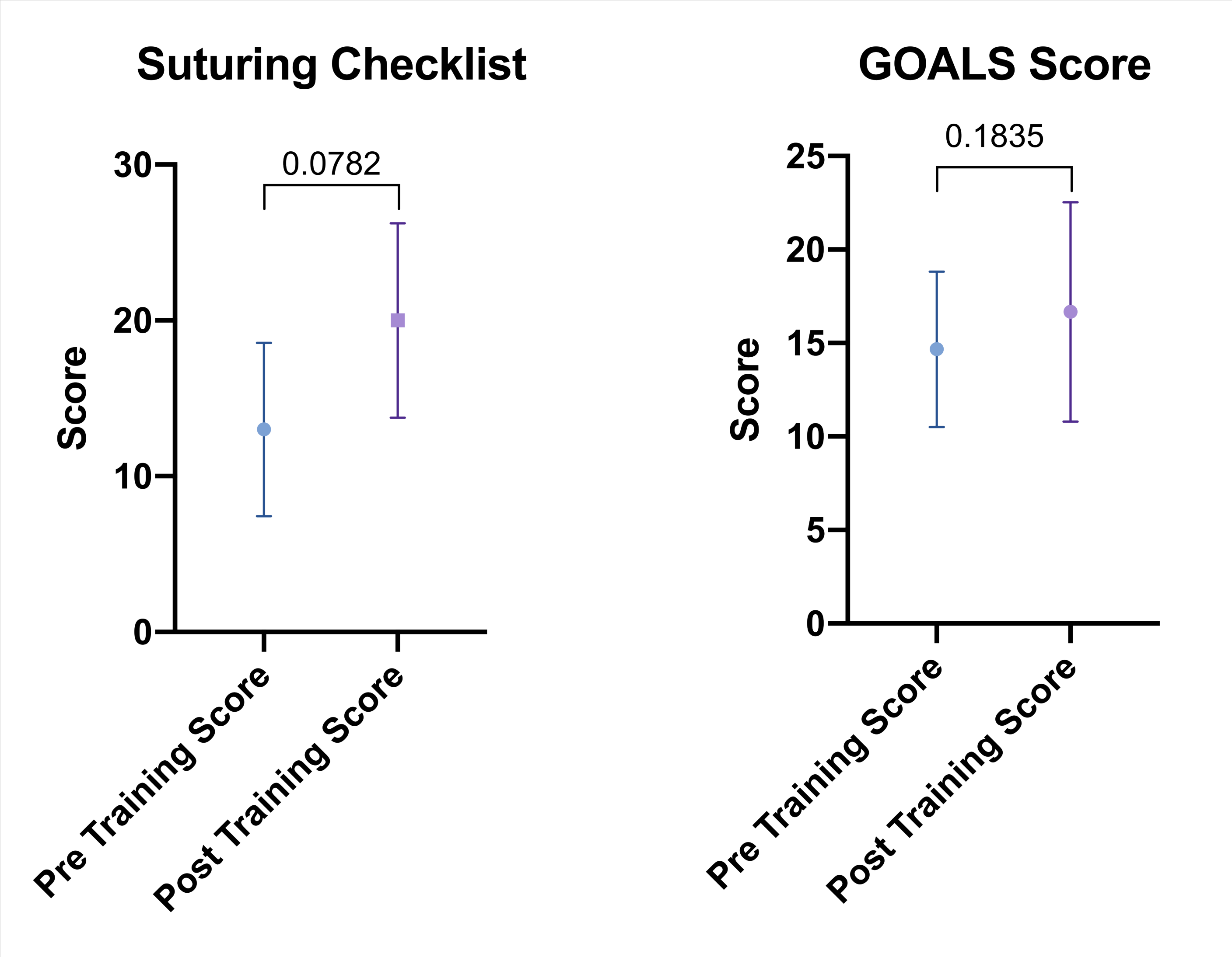




Results: Functional Connectivity Analysis



Results: Laparoscopic Skills Assessment



Conclusions

- MI training for a surgical task results in measurable changes in rsFC
  - Involvement of the frontal and motor cortices
  - Short term training of a complex motor task
- Larger study is required to address the limitations of this study

Many thanks to

- James Stirling & St Thomas' PET Centre

- Francesco Padorma and MR Physics Department

- King's College Imaging Research Access Fund