BOLD is thicker than white matter: Surgically disconnected temporal pole exhibits resting functional connectivity with remote brain regions NN12/63.13



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Introduction

• fMRI measures of resting state functional connectivity (RSFC) in the human brain have provided important insights into relationships between brain areas in the domains of cognition, development, and disease states.

 While studies have shown that functionally connected networks reflect anatomical connections between brain areas, there are reports of preserved RSFC in the absence of major white matter connections (e.g., in agenisis of the corpus callosum, Tyszka et al., 2011).

• A key test of the link between functional and structural connectivity would be to evaluate RSFC for a brain region that has been anatomically isolated through surgical resection.

<u>Hypothesis</u>: We hypothesized that surgical resection of white matter connections with the temporal pole would eliminate RSFC with that region, and predicted that analyses using the disconnected pole as an RSFC seed would find **no connectivity** with brain regions outside the disconnected pole

<u>Approach</u>: Measurement of temporal pole RSFC in patients who have undergone surgical disconnection of the temporal pole, compared to healthy adults

We identified patients with a surgically disconnected temporal pole and extensive resting-state fMRI data

• Temporal pole tissue is neuroanatomically disconnected but supported by pial blood supply • From an initial 57 potential cases with MRI imaging, only 12 were confirmed by surgeon review of MRI as fully disconnected.

• Of these 12, 6 cases had sufficient rs-fMRI for single case analysis (greater than 15 min of data collected) • One additional case was excluded for excessive motion (> 50% of volumes with FD > 0.2mm)



| | | | | | | Scan | | | Volumes | Mean FD | Total Volumes |
|-------|--------|-----------|-----|-----------|---------------|------------|------|------|---------|---------|----------------------|
| ID | Sex Ha | andedness | Age | Education | Full Scale IQ | Chronicity | TR | Runs | /run | (mm) | (after scrubbing) |
| 3360L | F | Right | 29 | 16 | 104 | 10 years | 2.26 | 4 | 216 | 0.11 | 759 (28min, 35s) |
| 3749L | Μ | Left | 41 | 18 | 92 | 9 months | 2.5 | 5 | 120 | 0.15 | 375 (15min, 38s) |
| 3786L | F | Left | 49 | 14 | 81 | 8 months | 2.26 | 4 | 216 | 0.07 | 843 (31 min, 45s) |
| 3753R | М | Right | 20 | 14 | 105 | 11 months | 2.26 | 5 | 130 | 0.04 | 650 (24 min, 29s) |
| 3794R | М | Right | 32 | 16 | 104 | 6 months | 2.26 | 4 | 130 | 0.05 | 496 (18min, 41s) |

Preprocessing: FSL 5.0.2.2, motion-correction, BET, 6.0 FWHM, grand-mean intensity normalization <u>Resting State Processing</u>: 0.008 < f < 0.08 Hz temporal filtering, white matter, CSF, whole brain, and lesion regression; motion-scrubbing (censoring frames with FD > 0.2mm); AFNI's 3dttest++ for fixed effects and singleton comparison, FSL cluster command for cluster based thresholding



Preoperative



Postoperative



Seed map example for 25 healthy comparison datasets, 1-sample t-test across subjects, Z > 3.1, p < .05 cluster thresholded



3749L







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The disconnected temporal pole shows significant functional connectivity with regions outside the disconnected

Disconnection seed maps for TD participants 1-sample t-test across runs, Z > 2.33, p < .05 cluster thresholded



The disconnected temporal pole participates in ICA components resembling well-replicated RSFC networks

Smith et al. 2009 RSN maps

Disconnected participant ICA component maps with RSFC in disconnected tissue & spatial correlation with Smith RSN maps



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