The role of the left and right inferior frontal gyrus in language recovery in aphasia
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INTRODUCTION
The mechanisms of the involvement of the left and right inferior frontal gyrus (IFG) in the process of post-stroke language recovery are not well understood. Some studies have underlined the role of LIFG in recovery mechanisms (Sebastian & Kiran, 2011; Saur et al., 2006; Frithdiksson, 2010). Other studies have implicated the RIFG in compensatory functions (Abo et al., 2004; Frithdiksson & Morrow, 2005).

Main Hypothesis: LIFG is very important in language recovery to the extent that LIFG tissue is spared post stroke. Research Question: What is the relationship between % spared tissue and % signal change 1) in the IFG and ipsilesional tissue? 2) in the IFG and corresponding contralesional tissue? 3) in the IFG and all other regions?

METHODS
Participants were scanned once while performing a semantic language task in English. Data Acquisition Parameters: T1: 140 sagittal slices, 1mm³ voxels, 240 x 240 matrix, FOV = 240 mm, flip angle = 8, fold-over direction = AP; TR = 8.2ms, TE = 3.8ms
BOLD:31 axial slices (3mm thick, 0.3 interslice gap), 3mm³ voxels, 80 x 80 matrix, FOV = 240, flip angle = 90, fold-over direction = AP, TR = 2000ms, TE = 35ms

Preprocessing in SPM8
- Lesion Masking (MRcron)
- Slice Timing
- Realignment
- Coregistration
- Segmentation (lesion masked as Brett et al., 2001)
- Normalization
- ART Repair (Mazukala et al., 2009)

Statistical Modeling in SPM8
- Fixed Effects Analysis using GLM
- Canonical HRF and its Temporal Derivative High Pass Filter of 128 s

RESULTS
1. Research Question 1: Correlations between % spared tissue and ipsilesional % signal change
   - Only one region, the IFG triangularis, showed a correlation that approached significance ($r = -1$, $p = 0.08$).

2. Research Question 2: Correlations between % spared tissue and contralesional % signal change
   - Two regions showed a significant negative correlation between ipsilesional spared tissue and contralesional signal changes:
     i. IFG opercularis ($r = -0.93, p = 0.003$)
     ii. IFG triangularis ($r = -0.85, p = 0.01$)
   - IFG opercularis to contralesional MFG ($r = -0.75, p = 0.07$) and IFG opercularis to contralesional HFG ($r = -0.78, p = 0.04$)

3. Research Question 3: Correlations between % spared tissue in IFG and % signal change in other brain regions
   - Three regions showed a significant negative correlation between ipsilesional spared tissue in the IFG and signal changes within the MFG, two approached significance:
     i. IFG opercularis to ipsilesional MFG ($r = -0.82, p = 0.03$)
     ii. IFG triangularis to ipsilesional MFG ($r = -0.85, p = 0.01$)
     iii. IFG opercularis to ipsilesional HFG ($r = -0.75, p = 0.07$)
     iv. IFG opercularis to contralesional HFG ($r = -0.78, p = 0.04$)

CONCLUSIONS
- Despite extensive damage, spared LIFG tissue shows consistent activation in a semantic task.
- In the IFGop and IFGtri increased damage is also associated with significantly increased signal change in the contralesional IFG and MFG and the ipsilesional MFG.
- When the IFG is not spared, contralesional IFG is engaged. When some IFG is spared, ipsilesional structures (IFG, MFG) are engaged.
- These data therefore highlight the importance of the preservation and consequent activation of left IFG in language recovery in aphasia.

REFERENCES
- Sebastian & Kiran (2011)
- Saur et al. (2006)
- Frithdiksson (2010)
- Abo et al. (2004)
- Frithdiksson & Morrow (2005)
- Brett et al. (2001)
- Mazukala et al. (2009)