INTRODUCTION

No published study has used neuroimaging to explore the active ingredients of an empirically-based treatment (EBT) for substance abuse. An EBT with strong evidence of efficacy (Hettema, Steele, & Miller, 2005), motivational interviewing (MI) is a strong candidate for such a study. A growing body of evidence indicates promising support for a specific mechanism of action, change talk, in MI (Amrhein, Yahné, Palmer, Miller, & Fulcher, 2003; Houck & Moyers, 2008; Moyers, Martin, Houck, Christoph, & Tonigan, 2009).

The present study is a preliminary exploration of the brain activity underlying participants’ perception of their own change talk from an MI session using magnetoencephalography (MEG), a technique that uses superconducting sensors to infer the timing and location of electrical activity within the brain.

METHOD

Participants were six individuals (4 male, 2 female; mean age 47.5, SD 17.4) who were ambivalent about their substance use. This dataset represents 1/5 of the planned sample for this study, which is ongoing. Each participant had a recorded MI session with Dr. Theresa Moyers. Following each participant’s session the precise time of each change talk (CT) or sustain talk (ST) utterance was noted, and these utterances were extracted from the audio recording as separate files.

During the MEG scan participants heard approximately 200 repetitions of each utterance type, intermingled and presented in a random order. MEG data were sampled at 1000 Hz using a 306-channel MEG array (Neuromag™, Elekta AB) at the Mind Research Network (Albuquerque, NM). MEG data were co-localized to the anatomical MRI of each subject using a Polhemus head position device. Using Elekta Neuromag Maxfilter™ software, signal artifacts and the effects of participant head movements were removed.

Waveforms were averaged off-line over trials and band-pass filtered (1-45 Hz, width .1 and 10 Hz respectively). A baseline consisting of 100 ms prior to stimulus onset was used. Current source distributions were calculated using Minimum Norm Estimation software (MNE; Hämäläinen, 2009), which explains observed brain activity using the smallest possible number of sources. Four sites of interest in the left hemisphere were selected a priori for analysis: temporal pole, middle temporal gyrus, superior temporal sulcus, and planum temporale (see Figure 1). Sites of interest were extracted using automated labeling in Freesurfer (Fischl & Dale, 2009).

Evoked response field measures including peak amplitude, peak latency, and onset latency were compared between CT and ST across sites of interest using the multivariate approach to repeated measures ANOVA.

RESULTS

MANOVA revealed a significant Condition × Site interaction \(F(9,45) = 2.784, p = .011\), as well as significant main effects for Condition \(F(3,3) = 589.428, p < .001\) and Site \(F(9,45) = 3.296, p = .004\). Peak amplitude was significantly greater for ST in middle temporal gyrus, while onset latency was earlier for CT in middle temporal gyrus and planum temporale.

SUMMARY

Results from a range of studies (e.g., Gaume, Gmel, & Daeppen, 2008; Baer et al., 2008; Hodgins, Ching, & McEwen, 2009) have supported change talk as a mechanism of action in MI. Consistent with the basis of MI in social cognitive theories, clients truly do appear to talk themselves into change during their interactions with their therapists.

The present study suggests that when clients hear their own change language, they process CT and ST differently at the neural level. These differences in the neural processing of CT and ST are apparent even at early latencies. Differences between CT and ST processing in particular frequency bands have also been observed (Houck, Moyers, & Tesche, 2010). Despite the complex social cognitive nature of CT and ST, it appears that differences between the two may become apparent at very early processing stages. Further analysis as the full sample becomes available will explore functional connectivity, with the hypothesis that a social-cognitive brain network forms a neural substrate for client change language.

REFERENCES


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The neural substrate of change talk in motivational interviewing: A first look

J.M. Houck, T.B. Moyers, and C.D. Tesche

Center on Alcoholism, Substance Abuse, and Addictions (CASAA)

University of New Mexico
http://casaa.unm.edu