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Frontal electroencephalographic (EEG) activity and mediumship: a comparative study between spiritist mediums and controls

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Abstract

Mediumship and spirit possession are cultural phenomena found worldwide. The Spiritism, popular in Brazil, is a religious tradition that emphasizes mediumship. The “absorption hypothesis” (the association of marked increases in focused attention with concomitant decreases in self-awareness) is one of the neuropsychological explanatory theories for these experiences. We measured electroencephalographic (EEG) spectral power in frontal electrodes within theta, alpha and beta bandwidths, as well as cross-regional cortical coherences, in female Spiritist experienced mediums (n = 10) and in female non-medium control subjects from the same religious context (n = 10). Scalp EEG signals were captured simultaneously from participants in each of the two groups in three different moments: before, during and immediately after mediumistically speaking. Compared to non-medium controls, the mediums had greater beta power on some electrodes in all phases of the experiment, greater theta power on one electrode at the communication phase and greater alpha power on one electrode at the post-communication phase. No condition effects (within-group comparisons) were detected in any group. No group effects were noted for cross regional cortical coherences. No ictal EEG pattern was observed, except for one participant in the mediums group. These findings support the hypothesis that absorption could have a mechanistic role in anomalous sensorial experiences such as mediumship. The coherence pattern in mediums during the anomalous experience differed from prior studies on pathological dissociation and on hypnotic states. Cognitive control processes seem to be engaged during the anomalous sensorial experiences.


Keywords: Mediumship, dissociation, EEG, EEG coherence, theta rhythm, beta rhythm

Introduction

Mediumship can be defined as the alleged ability to communicate with deceased personalities on a regular basis1. This is a cultural phenomenon found in almost every society worldwide2, and it can manifest itself in various forms, e.g., hearing or seeing spirits, spiritual possession, or talking and writing under the influence of spirits, among others. The Spiritism, popular in Brazil, is a religious tradition that emphasizes such experiences. Currently, one of the most widely accepted neuropsychological theories to explain mediumship and other spiritual experiences with sensorial alterations is the “absorption hypothesis”3. Absorption is the capacity to direct the focus of attention to externally or an internally (thoughts, emotions, memories) generated stimulus, and to allow that focus to increase while decreasing attention to the multitudinous distractions of daily life. In these circumstances, mental activities of reality monitoring, that is, basic decisions about whether the source of an experience is internal to the mind or external in the world, may be impaired and perceptual “breaks” may result4,5.

There has been a long discussion within psychology and psychiatry about whether these type of events are real, spontaneous modifications in brain states that reflect basic neurobiological phenomena, or whether they are imaginary, socioculturally constructed role performances. In most Western societies, when a person has sensorial experiences and behaviors felt as the non-self, this is usually interpreted as a sign of mental disease, and the majority of mental health professionals interpret these phenomena as “communicating spirits” as fragments of the individual’s own self and inner conflicts4,5. However, other scholars, in light of evidence stemming from controlled studies about the accuracy of mediumistic communications and about “near-death” experiences, consider plausible that some individuals, in altered mental states, could actually communicate through extra-sensorial perception with some form of non-local consciousness6-8.

Dissociative experiences have been thought to exist on a continuum, ranging from non-pathological absorption through hypnosis, to more profound and prolonged experiences that include dissociative amnesia and alterations in identity (e.g., Dissociative Identity Disorder). Dissociation is widely accepted as a sort of built-in defense mechanism that allows individuals to shield psychologically themselves from extreme emotions and arousal triggered by a traumatic event. However, while some degree of dissociation may be considered adaptive in the short-term, prolonged and/or intense dissociative responses are deemed maladaptive (e.g., dissociative identity disorder, posttraumatic stress disorder). Nevertheless, in some contexts, dissociation is not related to trauma at all, and therefore it likely has very different functional implications6. The question of whether pathological and non-pathological dissociation share a common pattern of neural activation and of physiological responses remains open.

Greater pain insensitivity in carriers of dissociative disorders has been associated with higher electroencephalographic (EEG) theta activity9. Likewise, both in pathological and non-pathological contexts, EEG theta activity was positively correlated with DES (Dissociative Experiences Scale) scores8,10. The coherence is a measure that quantifies the covariation of power spectra within specific frequency bands among pairs of EEG electrodes, being an index of synchronization between cortical areas. Greater coherence between such areas indicates that they are functionally connected11. In healthy individuals, situations of great emotional load (which demand engagement of cognitive control mechanisms) have been associated with increased frontal-posterior EEG coherence compared to emotionally neutral conditions12. A study investigating EEG coherence in individuals with
psychogenic nonepileptic seizures (PNES), a dissociative disorder, found decreased fronto-parietal coherence in carriers compared to control participants. Moreover, they found an inverse correlation between the number of events and fronto-parietal coherence15.

Hypnosis can be defined as a state of focused attention, concentration and inner absorption with a relative suspension of peripheral awareness. Hypnosis has three main components: absorption, dissociation and suggestibility14. Based on results of functional neuroimaging studies, some authors argue that highly hypnotizable individuals have frontal attentional systems that work more efficiently15. At the basal state, highly hypnotizable individuals usually have greater cortical coherence20, although some investigators report decreases in fronto-posterior synchrony during hypnosis21. There is a positive correlation between scores of hypnotizability and EEG theta power16. Highly hypnotizable individuals have greater probability to report converive symptoms20.

The literature about electroencephalographic correlates of culture-bound nonpathological dissociative experiences such as mediumship and possession trances is sparse.

Delorme et al.16 investigated the EEG from six North-American “professional mental mediums” and observed significant correlations for two mediums: in one medium theta power was negatively correlated with accuracy of the mediumistic information, and in the other participant alpha power was positively correlated with accuracy. In the same article, they reported the finding that gamma and beta waves were the frequency bands that could differentiate mediumistic communication and mental tasks of perception. In other study from Indonesia (possession trance during a religious ritual), Ohashi et al.19 reported a case of intense increase of theta and alpha power during the possession trance state (without ictal EEG pattern), persisting in the recovery (post-trance) phase, which was not the case in the control participants. Likewise, in a Brazilian study, Hageman et al.20 analyzed nine Brazilian Spiritist mediums EEG and found an absence of epileptic discharge on the EEG during mediumistic communication, as well as a slowing of background activity in six participants.

Hence, research experiments investigating culture-bound nonpathological dissociation are necessary to advance our understanding of dissociative phenomena and their mechanisms.

EEG is a sensitive non-invasive method with portable technologies that allow it to be used in situ, in cultural context21. The specific aim of the present field study was to investigate frontal electroencephalographic activity in Spiritist mediums from Brazil and compare them with non-medium control subjects from the same cultural context. Given the findings of research on mediumship to date, it was hypothesized that, in response to the mediumistic experience, significant differences in EEG parameters would be found between mediums and non-medium control participants.

Methods

This is a comparative study carried out in the city of Campo Grande, Brazil from July 2014 to February 2015. As the present report concerns part of a work that had also focused on other peripheral correlates of mediumistic experiences (Bastos Jr. et al., submitted for publication), the methods described below are in part the same as those set in that other manuscript.

Participants

To find qualified mediums, investigators contacted a regulatory organization for Spiritism in Campo Grande, central-west region of Brazil. The board of directors of this institution (Spiritist Federation of Mato Grosso do Sul) indicated that there were five different Spiritist centers, where standardized disobsession meetings (a type of Spirit release therapy) took place on a weekly basis. According to the practitioners of Spiritism, obsession may be defined as the persistent action that a morally inferior “spirit” exerts on an individual22 and the disobsession meeting is a common Spiritist practice, where the claimed mediums act as instruments allowing the dialogue with the “spirits”22–23. The Spiritist disobsession meetings usually include an average of eight to ten participants, each performing one of the following alleged roles: the leader (or dialoguer, responsible for enlightening the communicating Spirit); mediums (responsible for speaking under the influence of a Spirit) and support staff (responsible for making mental prayer and energetic irradiation).24 For this study, according to the roles they usually played in these meetings, participants were divided into two groups. Ten subjects allegedly capable of mediumistic speaking (mediums group) and ten subjects who were members of the support staff of the meetings (controls group). For each participant recruited for the mediums group (MG), a member of the support staff of the same meeting team was also recruited to constitute the controls group (CG). Study participants were invited consecutively from these centers by two investigators (MAVBJ and DIJ), and the research was presented to candidates as a potential contribution to the scientific understanding of mediumistic experience.

For reasons of convenience, investigators decided to include only adult females in this experiment. In the mediums group, only individuals participating as mediums in disobsession meetings for five years or more were included. For the controls groups, the recruitment of a woman of a similar age was tried whenever possible. Exclusion criteria for both groups were pregnancy, people of indigenous origin, smoking, history of severe traumatic head injury or meningitis, diagnosis of cardiovascular disorders (including hypertension), epilepsy, psychiatric illnesses, hypothalamic or pituitary diseases, chronic diseases (e.g., chronic renal failure, lung disease, diabetes mellitus) as well as current use of psychiatric medicines or anti-epileptic drugs.

Study design

Data from participants were collected on separate occasions with two subjects on each occasion (one from MG and one from CG). All data collection took place in the Spiritist center that participants usually attended to maintain the routine, format and schedules of the disobsession meetings. Each subject participated in only one group, and each subject had been tested and had her data tabulated only once. The EEG signal capturing was undertaken in three different moments: 1) a basal 7-minute recording 30 minutes before the start of the meeting, 2) a recording simultaneous to the mediumistic communication by the medium under study (called during communication) and 3) a 7-minute recording immediately after the mediumistic communication (called post-communication). At each data collection, the same experimental procedures were undertaken simultaneously for both groups (MG and GC).

Self-reported instruments

Participants answered the following questionnaires prior to each experimental session:

- The Questionnaire on mediumship (adapted from Negro Jr. et al.)24, consisted of simple questions to assess the degree of training, frequency and nature of mediumship behavior of participants. Moreover, at the end of the experiment, MG participants were also asked to fill out a self-reported scale (10 cm-long line, numbered from zero to ten) rating whether the experimental procedures had any influence on their mediumistic communication, with 0 meaning no influence at all and 10 meaning a very serious influence.
- The Anomalous Experiences Inventory (Menezes Jr. et al.)25 is a fourteen-item multiple-choice instrument where participants report which of the following anomalous experiences (AE) have already happened to them: apparitional experiences, spiritual hearing, spiritual perception, abnormal dreams, out-of-body experiences, foretelling, unexplained loss of energy, possession, intuition, spiritual perception of odors,
physical manifestations of spiritual cause, psychography, telepathy and spiritual healing.

- Mental health was assessed with the “Self-Report Psychiatric Screening Questionnaire” [SRQ-20] validated in Portuguese. This is a 20-item questionnaire formulated to detect common mental disorders, at the primary care level. It covers three groups of symptoms: negative affect (9 items), somatic complaints (8 items), and hopelessness (3 items). Seven or more positive (yes) answers suggest a mental disorder.

- Quality of life was assessed with the “12-Item Health Survey – SF12” [Short Form-12 or SF-12; Quality Metric Inc.] validated in Portuguese. This is a selfreport multidimensional instrument of quality of life, which comprises twelve items grouped into physical or mental health components. The final score can range from 0 to 100, where 0 corresponds to worse general health and 100 to the best health status.

- The Subjective State Evaluation is a well-being scale (10 cm-long line, numbered from zero to ten), containing questions on general well-being, peace, happiness, spiritual well-being, nervousness and irritability during the week in which the experiment was undertaken.

Electroencephalogram (EEG)

During all phases of electroencephalographic signal acquisition, the ambient lights were diminished, all the subjects were sat comfortably with the eyes closed and they were asked to avoid blinking or moving to minimize the amount of muscular artifacts. For signal acquisition, two identical pieces of Neuromap EQSA260 (Neurotec, Itajubá, MG) EEG equipments, with 22 channels, were used. Pass filters were configured for 0.5-70 μV and Notch 60Hz filters were used. The use of such filters is of paramount importance in field studies as this one, given that the 60Hz noise artifacts due to inadequate grounding of the electric circuits from the data collection sites may otherwise seriously contaminate the EEG records. The tin electrodes were fixed on the scalp with electroconductive paste according to the International 10-20 System.

The signal captured on a certain electrode was the result of the difference in the electric potential between that site of the scalp and the pre-established reference. The impedance levels on each electrode were assessed “a priori” through visual analysis of the EEG trace and with impedance tests of the equipment software. Electrode impedance levels lower than 20 K Ohms were sought. After each experimental mediumistic meeting, the digital files with the EEG records of participants were e-mailed to the neurophysiologist of the research team (KARCM) that imported the files to the Neuromap EQSA260 software and then blindly assessed the EEG data.

The EEG data were extracted from 2-second epochs (20 epochs for each phase of recording) and various EEG montages were used, mainly Cz reference and ear reference. Thorough visual inspections of the EEG traces were undertaken, so that only epochs free of muscular artifacts were selected. Taking into account that in communication phase the mediums were dialoguing and that this could contaminate the trace with muscular artifacts, the moments in which mediums were talking were not selected for analysis. All EEG records were assessed to evaluate the presence of ictal pattern. The spectral power densities were estimated and the power in the following frequency bands were determined: delta [0-3.9Hz], theta [4-7.9Hz], alpha [8-12.9] and beta [13-32Hz]. It was not possible to analyse data from gamma frequency [30-70Hz] because the built-in frequency range of the equipments that were used was the 0-32Hz range. We opted not to include data of delta power in the statistical analysis band, as blinking and body movement artifacts more commonly contaminate this frequency range.

The available evidence strongly suggests an association between frontal cortex areas with motivation, planning and emotion control mechanisms. As these areas are widely accepted as being involved with spiritual experiences (reviewed in Peres and Newberg, 2013), in the present study only spectral power from frontal electrodes (Fp1, Fp2, F3, F4, F7 and F8) were used for the final analysis. Before the statistical analysis, spectral power values were converted to the unit Log [μV²] /Hz, given that this is the most frequently unit used in recent studies on mediumship. The other EEG variables that were assessed were background activity, percent time in which each frequency band (% delta, % theta, % alpha and % beta) was observed and coherence.

The literature indicates that long distances cerebral coherence occurs mainly in the beta and in the theta frequency bands. Therefore, in the present study, the following electrode pairings were examined – nine frontal interhemispheric: Fp1-Fp2, Fp1-F4, Fp1-F8, F3-Fp2, F3-F4, F3-F8, F7-Fp2, F7-F4, F7-F8; nine left interhemispheric: Fp1-T5, Fp1-P3, Fp1-O1, F3-T5, F3-P3, F3-O1, F7-T5, F7-P3, F7-O1; nine right interhemispheric: Fp2-T6, Fp2-P4, Fp2-O2, F4-T6, F4-P4, F4-O2, F8-T6, F8-P4, F8-O2, both in beta and in theta frequency range. In order to reduce the number of statistical tests required, we grouped coherence pairs into anatomically valid clusters, corresponding to the left and right, prefrontal and posterior association cortex regions (left frontal cluster: Fp1, F3 and F7; left posterior cluster: T5, P3 and O1; right frontal cluster Fp2, F4 and F8; right posterior cluster: T6, P4 and O2), and coherence was averaged (adapted from Miskovic and Schmidt, 2006).

Statistical analysis

The data collected were entered to the SPSS 20.0 statistics package (IBM Corporation, Armonk, USA). Demographic and psychometric data for the groups were compared using the Chi-square test (categorical variables) and Mann-Whitney test (ordinal variables). Electroencephalographic data (continuous variables) from pre-communication, during communication and post-communication phases were subject to independent t-tests with a between-subject factor of group (mediums group vs. control group). Because there were three moments of electroencephalographic data collection, one-way repeated-measures ANOVA tests were performed to determine within-group condition effects (pre, during and post-communication). Then, a Bonferroni post hoc analysis was performed. A p value < 0.05 was considered statistically significant and the confidence interval was set at 95%. Values are reported as means ± standard error of means (SEM). An independent statistician conducted all statistical analyses under blind circumstances.

Ethical issues

The study was approved and monitored by the Institutional Review Board of the Federal University of Mato Grosso do Sul (ethical appraisal n. 625.917). The study was carried out in accordance with the International Ethical Guidelines and Declaration of Helsinki. All participants, as well as the legal representatives of the Spiritist centers involved, received written and verbal information about the experiment and gave written consent prior to enrollment.

Results

Sociodemographics

Twenty healthy Brazilian females (age: 50.9 ± 3.1 years) participated in this study (10 for the CG and 10 for the MG). All of them live in the city of Campo Grande, and most of them were married (75% [15/20] vs. 15% [3/20] single), Caucasian (70% [14/20]) and had attained a high educational level (100% [20/20] had graduated college or graduate school). No difference in participants’ age (MG: 57.2 ± 2.8 vs. CG: 44.6 ± 4.9 years, p = 0.09), marital status (p = 0.30), ethnicity (p = 0.71) or educational level (p = 0.51) was noted between the groups.
Self-reported instruments

Subjects in the MG had volunteered as mediums at the religious centers for a long period of time (22.8 ± 3.3 years; range, 7 to 40 years), most of them acted as mediums (9/10) for more than ten years. They reported first manifesting symptoms of mediumship by 19.9 ± 3.7 years of age (range, 3 to 38 years). Half of the mediums (5/10) described full consciousness during psychophony, whereas some (4/10) reported partial consciousness and only one described complete unawareness during the phenomenon. All subjects reported being in control of the mediumship phenomenon: most of them (6/10) reported always being in complete control, and the others (4/10) reported to be frequently in control of the experience. All mediums (10/10) reported to have formal mediumship training, which consisted of religious courses (weekly meeting and supervision with a duration of one year or more). Most of the subjects in the MG reported very little influence of the experiment procedures on their predominant answer (0-10 scale): 0.2 ± 0.2 (range, 0-2).

Subjects in the MG reported a significantly higher number of anomalous experiences than the subjects in the CG (8.0 ± 0.9 vs. 2.7 ± 0.5, p = 0.001). No differences in subjects’ mental health were noted between the groups. Mean SRQ scores of the MG and CG was 2.0 ± 0.6 vs. 3.3 ± 1.0, p = 0.43. All subjects in the MG scored lower than the cut-off of 7 positive (yes) answers, whereas two participants in the CG scored higher than the cut-off (tracking an increased probability of developing common mental disorders). No difference in participants’ quality of life was noted between the groups. Mean SF-12 scores of the MG and CG was 55.9 ± 1.2 vs. 50.6 ± 3.1 (p = 0.12) for mental health component, and 56.9 ± 1.2 vs. 55.0 ± 2.2 (p = 0.39) for physical health component. All of these mean scores are about average compared to the general population. No differences in participants' well-being (Subjective State Evaluation) was noted between the groups (data not shown).

Electroencephalogram (EEG)

There were valid EEG data from the pre-communication and the communication phases of all participants from both groups (GM: n = 10 and GC: n = 10), however, from the post-communication phase there were valid EEG data from only five participants from each group. It occurred because some participants were also taking part in another experiment, in which they asked to withdraw the EEG electrodes and undertake other measurement procedures after the communication (reported in Bastos Jr et al. – submitted for publication). Before EEG recording, the electrodes impedance levels has been checked through visual analysis in every participant. However, the checking of electrodes impedance levels through the equipment software test was not undertaken in every occasion given the scarcity of time (as it was a field study and the preservation of customary schedules and structures of the meetings was sought).

In the pre-communication phase, mediums had higher mean beta power than non-medium controls on the following electrodes Fp2 (p = 0.001), F4 (p = 0.040), F7 (p = 0.035) and F8 (p = 0.026) (Table 1). In the communication phase, mediums had higher mean beta power than non-medium controls on the electrodes F7 (p = 0.043) and F8 (p = 0.032), and higher mean theta power on the electrodes F7 (p = 0.014) (Tables 1 and 2). In the post-communication phase, mediums had higher mean beta power than nonmedium controls on the electrodes F8 (p = 0.031), and higher mean alpha power on the electrodes F4 (p = 0.037) (Tables 1 and 3).

No group effect was noted for the background activities or for the frontal interhemispheric, the left frontal-posterior or the right frontal-posterior coherences. Likewise, no group effect was noted for percent time in which each frequency band was observed, except for a significantly greater percent of theta rhythm in the non-medium controls’ group compared to MG (p = 0.035), at the post-communication phase (Table 4).

No condition effects (intra-group comparisons pre-, during and post-communication) were detected for any of the electroencephalographic parameters, as assessed by one-way repeated-measures ANOVA tests, followed by Bonferroni corrections (data not shown). During communication, there was a slowing of mean background activity in the MG and, conversely, an acceleration of mean background activity in the CG, which was accentuated at the post-communication phase. However, these between-group differences did not reach statistical significance. A slowing of alpha background activity was observed in 4/10 participants in the MG and in 1/10 participants in the CG.

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Table 1. Between-group comparisons of beta power (Log [µV²/Hz]) in frontal electrodes – pre, during and post-communication

<table>
<thead>
<tr>
<th></th>
<th>Pre-communication</th>
<th>During communication</th>
<th>Post-communication</th>
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<tbody>
<tr>
<td></td>
<td>Medians</td>
<td>Controls</td>
<td>p+</td>
</tr>
<tr>
<td>B-Fp1</td>
<td>0.2 ± 0.1</td>
<td>0.1 ± 0.1</td>
<td>0.628</td>
</tr>
<tr>
<td>B-Fp2</td>
<td>0.4 ± 0.0</td>
<td>-0.1 ± 0.1</td>
<td>0.001*</td>
</tr>
<tr>
<td>B-F3</td>
<td>0.2 ± 0.1</td>
<td>0.0 ± 0.1</td>
<td>0.235</td>
</tr>
<tr>
<td>B-F4</td>
<td>0.2 ± 0.1</td>
<td>0.0 ± 0.1</td>
<td>0.040*</td>
</tr>
<tr>
<td>B-F7</td>
<td>0.2 ± 0.1</td>
<td>0.0 ± 0.1</td>
<td>0.035*</td>
</tr>
<tr>
<td>B-F8</td>
<td>0.2 ± 0.1</td>
<td>0.0 ± 0.0</td>
<td>0.026*</td>
</tr>
</tbody>
</table>

* Standard error of the mean/ Independent t-test/ * p < 0.05.

Table 2. Between-group comparisons of theta power (Log [µV²/Hz]) in frontal electrodes – pre, during and post-communication

<table>
<thead>
<tr>
<th></th>
<th>Pre-communication</th>
<th>During communication</th>
<th>Post-communication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medians</td>
<td>Controls</td>
<td>p+</td>
</tr>
<tr>
<td>T-Fp1</td>
<td>1.2 ± 0.1</td>
<td>1.1 ± 0.1</td>
<td>0.521</td>
</tr>
<tr>
<td>T-Fp2</td>
<td>1.0 ± 0.2</td>
<td>1.0 ± 0.1</td>
<td>0.916</td>
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<tr>
<td>T-F3</td>
<td>1.1 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>0.549</td>
</tr>
<tr>
<td>T-F4</td>
<td>1.2 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>0.261</td>
</tr>
<tr>
<td>T-F7</td>
<td>1.3 ± 0.1</td>
<td>0.9 ± 0.0</td>
<td>0.082</td>
</tr>
<tr>
<td>T-F8</td>
<td>1.2 ± 0.1</td>
<td>1.0 ± 0.0</td>
<td>0.288</td>
</tr>
</tbody>
</table>

* Standard error of the mean/ Independent t-test/ * p < 0.05.
No ictal EEG pattern was observed in any of the participants in the CG in any phase of the experiment, whereas one participant in the MG had an ictal pattern in pre-, during and post-communication phases of the experiment. Posteriorly, this participant was submitted to a standard electroencephalogram in a Neurology Clinic, out of the mediumistic meeting context, which was considered as a normal exam both by the Clinic staff as by the research team Neurologist. She had no history of epilepsy and she remained asymptomatic until the writing of this manuscript.

**Discussion**

In the present field study, we found differences in the frontal electroencephalographic activity between women allegedly experiencing mediumistic communication and non-medium control women from the same cultural context. Compared to non-medium controls, the mediums had greater beta power on some electrodes in all phases of the experiment (four electrodes at the pre-, two electrodes at the communication phase and one electrode at the post-communication phase), greater theta power on one electrode at the communication phase and greater alpha power on one electrode at the post-communication phase. Nevertheless, no condition effects (within-groups comparisons pre-, during and post-communication) were detected for any of the electroencephalographic parameters.

These findings corroborate with previous studies that have suggested an association of mediumistic and spirit possession experiences with greater theta and beta power\(^{18,19}\), as well as an association of dissociation with greater theta power\(^{16}\). However, contrary to the cases reported by Ooshashi et al\(^{19}\) and Delorme et al\(^{17}\), we found no between-group difference in alpha power during the mediumistic communication.

In fact, increases in beta and theta power usually reflect higher demands over brain attentional system to accomplish tasks\(^{20,21}\). A classic experimental model which puts into evidence this condition is the color-word interference test (or Stroop test). In this model, a conflict is created between an incongruent color and word (e.g., the word “blue” in font-color red) and, when the person is asked to name the color, the response time is slower than when the font-color matches the word (interference). It has been shown that the slower response time in the former case occurs because it requires more attention to monitor salient information, to suppress irrelevant information and to select appropriate responses\(^{22}\). In addition, direct correlations between the extent of interference and theta power, as well as between the extent of interference and prefrontal-posterior coherence (reflecting the engagement of cognitive control mechanisms) have been shown\(^{23,24}\). Likewise, other researchers have found significant increases of theta and beta activities as a result of prolonged intensive mental loading (calculation and choice-reaction tasks)\(^{25,26}\). Therefore, we consider it plausible that the greater beta and theta power observed in mediums in response to the unusual sensorial perception could result from involuntary hesitation and, akin to classic the Stroop test, increased attention demands to suppress inappropriate behavior and to fulfill the socially modeled task appropriately.

We found significantly greater alpha power on one electrode (F4) in mediums at the post-communication phase, which could be interpreted as reflecting cortical rebound resynchronization after the peak of mental arousal (with cortical desynchronization) that seems to have occurred during the communication phase\(^{27,28}\). No condition effect was observed for any electroencephalographic parameter in any group, we hypothesize this occurred as a result of the small sample size and because part of the electrocortical changes (e.g., mental arousal) were already present at the pre-communication phase and persisted to the immediately post-communication phase.

### Table 3. Between-group comparisons of alpha power (Log [µV²/Hz]) in frontal electrodes – pre-, during and post-communication

<table>
<thead>
<tr>
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<th>Pre-communication</th>
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<tr>
<td></td>
<td>Mean ± SE</td>
<td>Mean ± SE</td>
<td>Mean ± SE</td>
</tr>
<tr>
<td></td>
<td>Controls</td>
<td>Mediums</td>
<td>Controls</td>
</tr>
<tr>
<td>A-Fp1</td>
<td>1.1 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>1.0 ± 0.1</td>
</tr>
<tr>
<td>A-Fp2</td>
<td>0.8 ± 0.3</td>
<td>0.9 ± 0.1</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>A-F3</td>
<td>1.2 ± 0.1</td>
<td>1.1 ± 0.1</td>
<td>1.1 ± 0.1</td>
</tr>
<tr>
<td>A-F4</td>
<td>1.3 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>1.0 ± 0.1</td>
</tr>
<tr>
<td>A-F7</td>
<td>1.1 ± 0.1</td>
<td>0.9 ± 0.1</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>A-F8</td>
<td>1.1 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>0.8 ± 0.1</td>
</tr>
</tbody>
</table>

\(\text{Table 3. Between-group comparisons of electroencephalographic parameters (background activity, relative percent of the frequency bands, coherences in beta and theta bands) – pre-, during and post-communication.}\)

### Table 4. Between-group comparisons of electroencephalographic parameters (background activity, relative percent of the frequency bands, coherences in beta and theta bands) – pre-, during and post-communication

<table>
<thead>
<tr>
<th></th>
<th>Pre-communication</th>
<th>During communication</th>
<th>Post-communication</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SE</td>
<td>Mean ± SE</td>
<td>Mean ± SE</td>
</tr>
<tr>
<td>A-Fp1</td>
<td>1.1 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>1.0 ± 0.1</td>
</tr>
<tr>
<td>A-Fp2</td>
<td>0.8 ± 0.3</td>
<td>0.9 ± 0.1</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>A-F3</td>
<td>1.2 ± 0.1</td>
<td>1.1 ± 0.1</td>
<td>1.1 ± 0.1</td>
</tr>
<tr>
<td>A-F4</td>
<td>1.3 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>1.0 ± 0.1</td>
</tr>
<tr>
<td>A-F7</td>
<td>1.1 ± 0.1</td>
<td>0.9 ± 0.1</td>
<td>0.9 ± 0.1</td>
</tr>
<tr>
<td>A-F8</td>
<td>1.1 ± 0.1</td>
<td>1.0 ± 0.1</td>
<td>0.8 ± 0.1</td>
</tr>
</tbody>
</table>

\(\text{Table 4. Between-group comparisons of electroencephalographic parameters (background activity, relative percent of the frequency bands, coherences in beta and theta bands) – pre-, during and post-communication.}\)
Although the between-group difference was not statistically significant, we noted greater prevalence of slowing of EEG background activity in mediums compared to non-medium controls, replicating the findings of Hageman et al.28 and Oohashi et al.19. Klimesch12 states that during the performance of a cognitive task there may be phasic changes on the EEG background activity and that a phasic slowing of the alpha rhythm reflects engagement of attentional neural processes, whereas a phasic acceleration of the alpha rhythm reflects engagement of memory mechanisms. Hence, this information corroborates the spectral power findings of the present study and reinforces the hypothesis of predominance of attentional processes in mediums during and immediately after communication. Moreover, the participants in the CG had greater percent of theta rhythm at the post-communication phase and this may indicate greater somnolence in these individuals at this phase of the experiment19.

Contrary to the pattern of decreased synchronization that has been described to occur in pathological dissociation13 or during hypnosis17, in the present study, the analyses of clusters of electrodes revealed no between-group differences in frontal interhemispheric, left frontal-posterior or right frontal-posterior coherences whether in theta or in beta frequency range. In fact, in mediums’ group, a nonsignificant increase in average frontal interhemispheric and left frontal-posterior coherence was noted, both in theta and in beta frequency range. In the field of mediumship, many previous studies have underscored the fundamental role of training and the importance of the number of years of work as socially sanctioned mediums41. Contrary to novices, expert mediums are able to control the experiences and do not report suffering related to the anomalous sensorial experiences, in a process that clearly involves learning and cognitive control. As participants in the MG were expert socially sanctioned mediums, a normal or high level of brain coherence during the anomalous experience could be anticipated, reflecting high cognitive control. A different pattern of brain coherence might have been found if participants were novice mediums41.

The present study has limitations that should be mentioned. First, the exclusively female sample hinders any extension of study conclusions to males. Second, the small sample precludes any subgroup analysis. Third, because of a limitation of the EEG equipments we did not analyze gamma band activity, which could also be relevant for the brain connectivity data observed in this sample of experienced and mentally healthy mediums suggest that cognitive control processes seem to be engaged during the anomalous sensorial experiences. Further research on electroencephalographic correlates of mediumship is encouraged to evaluate gamma band activity, as well as to determine whether the described changes also occur in male mediums.

**Conclusions**

Taken together, the findings of the present study provide support for the hypothesis that absorption can have an important mechanistic role in anomalous sensorial experiences like mediumship and culture-bound spirit possession19. Replicating the few available prior EEG studies on this research field10,19, we observed that mediums had greater theta and beta power during the anomalous sensorial experience compared to non-medium controls. The lack of reduction in frontal interhemispheric and frontal-posterior coherence in mediums group during the alleged mediumistic communication clearly differs from the coherence pattern reported in pathological dissociation13 and during the hypnotic state25. The EEG spectral power and connectivity data observed in this sample of experienced and mentally healthy mediums suggest that cognitive control processes seem to be engaged during the anomalous sensorial experiences. Further research on electroencephalographic correlates of mediumship is encouraged to evaluate gamma band activity, as well as to determine whether the described changes also occur in male mediums.

**Acknowledgements**

The authors thank Quality Metric Inc. for providing authorized use of SF-12 instrument, the Spiritist Federation of Mato Grosso do Sul, the volunteers who took part in this study, and the psychiatrist Dr. Alex Leite de Mello for his encouraging support to this research.

**Conflict of interest**

All authors declare that they have no conflict of interest. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

**References**

Relationship between major depressive disorder and ACE gene I/D polymorphism in a Turkish population

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2 Gaziosmanpasa University, Faculty of Medicine, Department of Medical Biology, Tokat, Turkey.
3 Giresun University, Faculty of Medicine, Department of Medical Genetics, Giresun, Turkey.
4 Ati Evran University, School of Health, Kirsehir, Turkey.
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Abstract

Background: Major depressive disorder (MDD) is a complex disease and a significant health problem that is prevalent across the world. Angiotensin-converting enzyme (ACE) has an important role in renin-angiotensin system (RAS) and converts inactive angiotensin I to a potent vasopressor and aldosterone-stimulating peptide angiotensin II. Levels of ACE in plasma vary according to the insertion/deletion (I/D) polymorphism of ACE gene. Objective: The aim of the current study was to examine the influence ACE gene I/D variations on the risk of MDD. Methods: In the present case-control study, we analyzed ACE I/D polymorphism in 346 MDD patients and 210 healthy subjects using polymerase chain reaction technique. Results: Comparing the two groups, no significant difference was observed with regard to either genotype distributions or allele frequencies of the I/D polymorphism of ACE gene. Discussion: Our findings suggest that the ACE I/D polymorphism is not associated with MDD in Turkish case-control study. Further studies are still needed.


Keywords: Major depressive disorder, angiotensin-converting enzyme, polymorphism.

Introduction

Major depressive disorder (MDD) is a common psychiatric disease, often associated with morbidity and mortality. Although many factors were considered as the cause of this disease, its etiology has not been ascertained yet. Studies with families, twins and fosterlings reveal that genetic factors play an important role in its etiology. The prevalence of disease varies according to countries and age groups. Studies suggest that 10% to 15% of the general population will be exposed to clinical depression during their life. Although the etiopathogenesis of the disease is not fully understood yet, it has been estimated that a genetic susceptibility could be effective in the onset of MDD. Also, MDD is because of a complex genetic heterogeneity. Recent studies have shown that different genetic variants may contribute to the development of the MDD such as ACE gene polymorphism.

ACE gene, localized on chromosome 17q23, undergoes a polymorphism deriving from the presence (insertion, I) or absence (deletion, D) within intron 16, of a 287 base pair ALU repeat sequence. Although each allele are codominant effect to ACE levels, the homozygosity for I and D alleles have the lowest and highest levels of the enzyme, respectively. Additionally, the heterozygosity have no effect to serum ACE levels. ACE is also member of the renin-angiotensin system and acts a part in the conversion of angiotensin I to angiotensin II. Angiotensin II is a peptide hormone which acts as a stimulator of proinflammatory cytokines and interferes with hypothalamic-pituitary-adrenal (HPA) axis activation in response to stress. It is mentioned from the effect of the brain renin-angiotensin system in regulation of mood. It has been stated that ACE I/D polymorphism may be associated with suicide and MDD. ACE is responsible for degeneration of neurokinins that play an important role in regulation of emotions. Angiotensin II is both a potent neuropeptide and have essential roles in cognitive processes.

In some studies, it has been shown that ACE may contribute to the pathophysiology of psychiatric diseases by interacting with central dopamine. Therefore, it is important the investigation of ACE gene polymorphisms which are affecting an active to mood and personal stress. This case control study was designed to determine whether the ACE I/D gene polymorphism is related with susceptibility to MDD in Turkish population or not.

Material and methods

Subjects

In our study, 346 patients diagnosed with MDD (74 male and 272 female) and 210 healthy volunteers (75 male and 134 females as control group) who were recruited to Tokat Gaziosmanpasa University, Department of Psychiatry were included to the study. According to Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) criteria, the patient group comprises individuals diagnosed with major depression. Both the study group and control group were recruited from the Turkish population. Subjects included to the study were greater than 18 years old. Informed written consent was obtained from all patients and subjects before enrollment to the study, according to the ethical guidelines of the 2008 Declaration of Helsinki and the investigation was approved by the ethical, investigation and biosecurity committee of Gaziosmanpasa University Faculty of Medicine.

Genotype determination

This study was conducted in Gaziosmanpasa University, Department of Medical Biology and Genetics laboratories. Blood samples were collected from patients and controls. Genomic DNA was isolated from whole venous blood samples using a commercial DNA isolation kit (Sigma-Aldrich, Germany). In addition, after isolated, the DNA should be stored at -20°C. ACE gene I/D polymorphism genotypes

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were determined by polymerase chain reaction (PCR) using the primers and conditions described earlier. Reactions were performed with 10 pmol of each primer: sense oligo, 5′-CTG GAG ACC ACT CCC ATC CTTC TTG-3′, and antisense oligo, 5′-GAT GTG GCC ATC ACA TTC GTC AAG T-3′. Amplification was performed in a thermal cycler for 30 cycles with denaturation at 94°C for 40 s, annealing at 56°C for 40 s and extension at 72°C for 40 s, followed by a final extension at 72°C for 10 min. PCR products were analyzed on 2% agarose gels after staining with ethidium bromide and were visualized using a UV transilluminator. The polymorphisms detected by PCR were evident as an approximately 490-bp fragment in the presence of the insertion (I) allele and as an approximately 190-bp fragment in the absence of insertion (D) allele. In heterozygous samples, two bands (490 and 190 bp) were detected. In order to confirm the accuracy and reproducibility of this method, each PCR reaction included internal controls for each genotype. Second PCR was performed to confirm samples whose results were not clear.

**Statistical analysis**

All statistical analyses of data were performed using the computer software SPSS version 15.0 for Windows and OpenEpi Info software package program. Genotype distribution of the ACE gene and allele frequency between MDD patients and controls were compared by Chi-Square test. Odds ratio (OR) and 95% confidence intervals (CIs) were calculated. Hardy-Weinberg equation was applied to the polymorphism in both patient and control group were in Hardy-Weinberg equilibrium. It is determined that there was no statistical significant difference in the allele and genotype frequencies of ACE I/D polymorphism in patients and control group. The observed and expected frequencies of the polymorphism in both patient and control group were in Hardy-Weinberg equilibrium. It was reported that there was no association between schizophrenia and ACE I/D polymorphism. ACE, membrane-bound endopeptidase, is expressed in many tissues including brain. It is reported that ACE in neuroepithelial cells degrades neurotransmitters such as substance P, which has a role in depression and that angiotensin II interacts with dopamine in some specific parts of brain. Angiotensin II, acting as a stimulator of proinflammatory cytokines, makes changes on the hypothalamic-pituitary-adrenal (HPA) axis activation that develops in response to stress. ACE gene variations play a significant role in the HPA axis hyperactivity in depression. It has shown that variations in the ACE gene have an important impact on the HPA axis hyperactivity found in depression. It was reported that the depressive symptoms in schizophrenics was clearly associated with ACE I allele in the Chinese population and that D allele had a protective effect for schizophrenia in the Spanish population. The researchers were also interested in whether ACE gene polymorphism affected the responses to therapeutic agents. It was reported that high activity of ACE genotype was associated with unfavorable response to conventional therapy in schizophrenic patients. Kucukali et al. indicated that there was an association between D/D genotype and bipolar disorder in patients order and their first-degree relatives. On the other hand, data collected previously suggested that ACE I/D polymorphism could possibly be a biological marker of depression. On the basis of these findings, the studies related to the genetic background of the MDD patients will make an important contribution to the clarification of the relationship between ACE gene and MDD.

A meta-analysis evaluating the data of several studies indicated that there was no association between schizophrenia and ACE I/D polymorphism.

**Results**

Demographic variables and baseline characteristics of patients were presented in Table 1. The mean age ± standard deviation (SD) was 38.12 ± 12.74 years in patients and 36.47 ± 9.33 years in control group. There were 74 (21.4%) males, 272 (78.6%) females and 75 (35.7%) males, 134 (63.8%) females in patient and control groups, respectively. The observed and expected frequencies of the polymorphism in both patient and control group were in Hardy-Weinberg equilibrium. It determined that there was no statistical significant difference in the allele and genotype frequencies of ACE I/D polymorphism in patients and control groups (p > 0.05, OR 1.18, 95% CI 0.91-1.51) (Table 2). Agarose gel electrophoresis patterns of ACE gene I/D polymorphism were represented in Figure 1.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Control group, n (%)</th>
<th>Study group, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender, male/female</td>
<td>75/134 (57/63.8)</td>
<td>74/272 (21/47.8)</td>
</tr>
<tr>
<td>Age, mean ± SD, years</td>
<td>36.47 ± 9.33</td>
<td>38.12 ± 12.74</td>
</tr>
<tr>
<td>Weight, mean ± SD, years</td>
<td>70.97 ± 10.54</td>
<td>73.16 ± 12.25</td>
</tr>
<tr>
<td>BMI, mean ± SD, years</td>
<td>26.51 ± 3.78</td>
<td>28.12 ± 12.74</td>
</tr>
<tr>
<td>Age of onset</td>
<td>4.75 ± 5.12</td>
<td>4.75 ± 5.12</td>
</tr>
<tr>
<td>Disease duration</td>
<td>73/165 (50.7/69.3)</td>
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<tr>
<td>Civil status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Married</td>
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<td>Family history</td>
<td>150/88 (63/37.0)</td>
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</tr>
<tr>
<td>Depression score</td>
<td>19.22 ± 11.22</td>
<td></td>
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<tr>
<td>Anxiety score</td>
<td>22.07 ± 14.48</td>
<td></td>
</tr>
<tr>
<td>Pain score</td>
<td>19.62 ± 11.30</td>
<td></td>
</tr>
</tbody>
</table>

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<td>Pain score</td>
<td>19.62 ± 11.30</td>
</tr>
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</table>

**Table 1.** Clinical and demographic characteristics of the patients with MDD and healthy controls

<table>
<thead>
<tr>
<th>Gene</th>
<th>MDD patients n = 346</th>
<th>Healthy controls n = 210</th>
<th>p</th>
<th>OR (CI 95%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE I/D Genotypes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I/I</td>
<td>44 (12.7%)</td>
<td>34 (16.19%)</td>
<td>0.40</td>
<td>0.77 (0.46-1.23)</td>
</tr>
<tr>
<td>I/D</td>
<td>163 (47.1%)</td>
<td>101 (48.09%)</td>
<td>&gt; 0.05</td>
<td>0.75 (0.46-1.23)</td>
</tr>
<tr>
<td>D/D</td>
<td>139 (40.1%)</td>
<td>75 (35.71%)</td>
<td>&gt; 0.05</td>
<td>0.77 (0.53-1.10)</td>
</tr>
<tr>
<td>Alleles</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>251 (38.2%)</td>
<td>169 (40.23%)</td>
<td>0.18</td>
<td>1.18 (0.91-1.51)</td>
</tr>
<tr>
<td>D</td>
<td>441 (63.7%)</td>
<td>251 (59.78%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 2.** Genotype and allele frequencies of ACE gene polymorphisms in MDD patient and control groups

**Discussion**

In this study we assessed the association of ACE I/D polymorphism in patients with MDD. When we consider prevalence and etiologies of MDD, we think that the genetic background of MDD should be investigated. In this study, it was not found any association between patient and control groups in Turkish MDD population in terms of ACE I/D polymorphism. ACE, membrane-bound endopeptidase, is expressed in many tissues including brain. It is reported that ACE in neuroepithelial cells degrades neurotransmitters such as substance P, which has a role in depression and that angiotensin II interacts with dopamine in some specific parts of brain. Angiotensin II, acting as a stimulator of proinflammatory cytokines, makes changes on the hypothalamic-pituitary-adrenal (HPA) axis activation that develops in response to stress. ACE gene variations play a significant role in the HPA axis hyperactivity in depression. It has shown that variations in the ACE gene have an important impact on the HPA axis hyperactivity found in depression. It was reported that high activity of ACE genotype was associated with unfavorable response to conventional therapy in schizophrenic patients. Kucukali et al. indicated that there was an association between D/D genotype and bipolar disorder in patients order and their first-degree relatives. On the other hand, data collected previously suggested that ACE I/D polymorphism could possibly be a biological marker of depression. On the basis of these findings, the studies related to the genetic background of the MDD patients will make an important contribution to the clarification of the relationship between ACE gene and MDD.
polymorphism\(^{25,26}\), and the same result was supported in a study with the Caucasian population\(^{26}\), in consistent with our study results. While it was reported that bipolar disorder was not associated with I/D polymorphism\(^{27}\), another study suggested that it was associated with I/D genotype in the Asian race\(^{28}\). ACE gene polymorphism was reported not to be related to panic disorder\(^{29,30}\), although the frequency of I allele is higher in men than women\(^{31}\). Another study stated that there was an association between ACE gene polymorphism and MDD only in female patients\(^{32}\), as consistent to our results. Arinami et al. found that I/D genotype increased sensitivity to affective disorder\(^{32}\). However, mood disorders that started in childhood were reported not to be associated with ACE polymorphisms\(^{33,34}\). Studies conducted to examine the association between MDD and ACE did not show any link with ACE I/D polymorphism\(^{35,36}\). The same result was supported in Chinese population where it was reported that ACE gene polymorphism did not affect response to the treatment\(^{37}\). Also, Zill et al. suggest that aberrations in ACE promoter DNA methylation may be an underlying cause of MD\(^{38}\). Depression were also significantly associated with an increase in cortisol secretion and, it is stated that ACE gene rs4295, rs4311, rs4343, rs4291, rs4333 and rs4351 variational influences cortisol secretion\(^{39}\). ACE gene A2350G polymorphism was closely associated with MDD among Iranian population\(^{12}\). The same result was supported in a study with ACE I/D polymorphism and MDD only in female patients\(^{32}\), as consistent to our results. The authors declare no conflict of interest.

Conclusions

In the present study, we found a significant association between the ACE gene I/D polymorphism and MDD in Turkish population. The results cannot explain the role of ACE I/D polymorphism in the development of MDD. This polymorphism is not a susceptibility factor to MDD in the Turkish population. Although the present study does not provide any difference between the groups, we believe that there is a need for more comprehensive studies in different populations.

Conflict of interest

The authors declare no conflict of interest.

References

3. Lopizzo N, Bocchio Chiavetto L, Cattane N, Plazzotta G, Tarazi FI, Paria R. The association between ACE gene polymorphism and MDD in Turkish population. The results cannot explain the role of ACE I/D polymorphism in the development of MDD. This polymorphism is not a susceptibility factor to MDD in the Turkish population. Although the present study does not provide any difference between the groups, we believe that there is a need for more comprehensive studies in different populations.

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References

Brief report

Changing negative core beliefs with trial-based thought record

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DOI: 10.1080/01010560.2016.1170578

Abstract

Background: Trial-based thought record (TBTR) is a technique used in trial-based cognitive therapy (TBCT), and simulates a court trial. It was designed to restructure unhelpful core beliefs (CBs) during psychotherapy. Objective: To confirm previous findings on the efficacy of TBTR in decreasing patients’ adherence to self-critical and unhelpful CBs and corresponding emotions, as well as assessing the differential efficacy of the empty-chair approach relative to the static format of TBTR. Methods: Thirty-nine outpatients were submitted to a 50-minute, one-session, application of the TBTR technique in the empty-chair (n = 18) or conventional (n = 21) formats. Patients’ adherence to unhelpful CBs and the intensity of corresponding emotions were assessed after each step of TBTR, and the results obtained in each format were compared. Results: Significant reductions in percent values both in the credit given to CBs and in the intensity of corresponding emotions were observed at the end of the session (p < .001), relative to baseline values. ANCOVA also showed a significant difference in favor of the empty-chair format for both belief credit and emotion intensity (p = .04). Discussion: TBTR may help patients reduce adherence to unhelpful CBs and corresponding emotions and the empty-chair format seems to be more efficacious than the conventional format.

Keywords: Cognitive therapy, core belief, Kafka, trial-based thought record, trial-based cognitive therapy.

Introduction

Trial-based cognitive therapy (TBCT) is a three-level, three-phase, transdiagnostic, case formulation approach, based on Aaron Beck’s Cognitive Therapy, and inspired by the work of Franz Kafka. Joseph K., the main character in Kafka’s novel, “The Trial”, was unaware of the crime for which he was arrested and condemned without a chance to defend himself. According to de Oliveira’s interpretation, a similar trial can be observed in patients seeking psychotherapy, who are constantly accusing and sentencing themselves through their negative core beliefs (CBs), but are unaware of such self-accusations and unable to organize their own self defense.

Modifying dysfunctional CBs, understood as persistent attributions that are global, negative and personal regarding life events that are potential risk factors for the recurrence of most psychiatric disorders, often plays a significant role in cognitive behavioral therapy (CBT) protocols. These beliefs are usually developed early in life and set the scene for later beliefs, assumptions and automatic thoughts. Once patients rarely question the validity of CBs, the process of accessing and modifying them, leading to more constructive perception of current and future events, along with more enduring treatment outcomes, has become a frequent challenge and long-term goal for CBT therapists.

Over the last decade, TBCT has helped several patients around the world become aware of their CBs (self-accusations) and develop more realistic and functional views of themselves as a result of its unique approach to conceptualization and techniques that make it a distinct intervention in modifying patients’ CBs. One of its main techniques is the trial-based thought record (TBTR), an intervention aimed at modifying dysfunctional CBs by simulating a legal trial. TBTR incorporates elements from various techniques already known in standard CBT and other psychotherapeutic approaches. The patient has the opportunity to role-play him/herself not only as the defendant, but also as the prosecutor and defense attorney, as well as a member of the jury, as opposed to what usually happens when dysfunctional CBs are activated. TBTR may be conducted using the empty chair format, an experiential approach derived from Gestalt Therapy, in which the patient moves to different chairs to role-play different characters, or in the static format, in which the patient remains in the same chair during the session.

The first study on the efficacy of the TBTR in changing dysfunctional CBs and their corresponding emotions was conducted, and significant results (p < 0.001) were observed in the adherence to CBs and associated emotions of 30 patients, reinforcing the hypothesis that this technique could, at least temporarily, contribute to the weakening of unhealthy CBs and their related emotions. Subsequently, the intensity of patients’ dysfunctional CBs and corresponding emotions after the first use of the TBTR was assessed in a larger sample (n = 166), confirming the previous findings.

In a randomized trial in which the TBTR was compared with traditional CBT strategies, 36 patients presenting a diagnosis of social anxiety disorder (SAD) were evaluated. TBTR was at least as effective as conventional CBT in the treatment of SAD, and particularly effective in decreasing the fear of negative evaluation scores, supporting the relevance of further research with larger samples, and different disorders and populations. The same intervention also provided data demonstrating that TBTR was at least as effective as conventional CBT in improving several domains of quality of life in DAD. In addition, a significant treatment effect on the role-emotional domain at 12-month follow-up denoted a sustained effect of TBTR relative to conventional CBT.

Given this context, the present study, besides aiming at confirming previous findings on the efficacy of TBTR in decreasing patients’ adherence to their self-critical negative CBs and corresponding emotions, most importantly aimed at assessing the differential efficacy of the empty chair format of the TBTR, relative to the static format.

Methods

In this multi-center, parallel-group study, 39 outpatients presenting any psychiatric diagnoses were submitted to a 50-minute, one-session, application of the TBTR technique in the empty chair or static format by previously trained therapists, in the course of their CBT treatment.

A free web-based service that offers random assignment was used for randomization. A list of even/odd numbers (simple randomiza-
tion) was used to separate the group treatments. As soon as a therapist from seven different capitals in Brazil decided to use the TBTR with a patient, he/she sent an email to the last author's secretary to inform the patient's initials and request the treatment modality (static versus empty chair) that should be used.

Patients’ adherence to negative CBs and corresponding emotions were assessed after each step of the TBTR (investigation, prosecutor's plea, defense attorney's plea, prosecutor's second plea, defense attorney's second plea, jury's verdict and preparation for the appeal), and the results obtained in each format were compared. Statistical analyses involved a mixed (repeated measures) analysis of variance (ANOVA) to evaluate the efficacy of interventions. A one-way analysis of covariance (ANCOVA) was also conducted, using the baseline values from the investigation step of the TBTR as covariates. This research was approved by the Ethics Committee of Federal University of Bahia (Maternidade Climério de Oliveira), and all participants received detailed information about the study and signed an informed consent form.

### Results

Results of the mixed ANOVA indicated a significant main effect, meaning that significant reductions in percent values both in the credit given to the CBs and in the intensity of the emotions were observed at the end of the session (p < .001), relative to baseline (investigation phase) values (Table 1). There was no significant interaction between time and treatment. However, ANCOVA showed a significant difference in favor of the empty chair approach not only in the percentage adherence to the negative CBs but also in the intensity of the corresponding emotions (p = .04).

### Discussion

An intentional focus on changing CBs during the course of therapy has been widely emphasized in traditional CBT protocols. However, as far as we know, little is understood about how cognitive change leads to symptom reduction. Also, according to McManus et al., little is known about the efficacy of individual components of CBT, reinforcing the relevance of further understanding critical elements responsible for the efficacy, or comparing the efficacy of the different components in CBT protocols. Thus, in the present study, the authors aimed at supporting previous data on the efficacy of TBTR in reducing the strength of dysfunctional CBs as well as their associated emotions, not only in the static but also in the empty chair format of the intervention.

Similarly to what had previously been observed, significant reductions in the intensity of both negative unhelpful CBs and corresponding emotions were found at the end of the session, relative to initial values, as well as a significant difference in favor of the empty chair format for both belief credit and emotion intensity. The empty chair format has the advantage of engaging the patient in experiential learning, which is expected to be more effective in terms of belief and symptom change than other interventions that don’t reach the gut level, where enduring change is more likely to occur.

However, once TBTR incorporates several well-known techniques of conventional CBT and other psychotherapy approaches in its user-friendly structure, it can be quite challenging for the inexperienced clinician without proper training and supervision. Besides, addressing patients’ unhelpful negative CBs often requires extra caution from therapists, who are expected to be truly empathic and respectful regarding their patients’ experiences.

Taking the above considerations into account, the TBTR may help patients reduce their attachment to negative CBs and corresponding emotions, confirming findings from previous studies, and the empty chair format seems to be more efficacious than the conventional format in reducing the intensity of associated emotions.

This study is limited by the short duration of observation (just one intervention). However, this was the only way to proceed, because TBTR is not necessarily repeated in subsequent sessions, precluding any additional comparison. Furthermore, the sample is heterogeneous, comprising patients with many different diagnoses. These are important aspects to be investigated in future studies with more homogeneous samples in order to determine the precise role

### Table 1. Mean (SD) percentages of credit in the CBs and intensity of corresponding emotions in the total sample and in groups treated in the empty chair vs. static formats of TBTR

<table>
<thead>
<tr>
<th>TBTR steps</th>
<th>Total sample</th>
<th>Empty chair</th>
<th>Static</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 39</td>
<td>n = 18</td>
<td>n = 21</td>
</tr>
<tr>
<td>1. Investigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belief</td>
<td>85.13 (19.21)</td>
<td>82.50 (22.90)</td>
<td>87.38 (16.62)</td>
</tr>
<tr>
<td>Emotion</td>
<td>82.18 (19.99)</td>
<td>79.72 (19.59)</td>
<td>84.29 (20.57)</td>
</tr>
<tr>
<td>2. Prosecutor I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belief</td>
<td>91.15 (14.49)</td>
<td>92.78 (10.74)</td>
<td>89.74 (17.21)</td>
</tr>
<tr>
<td>Emotion</td>
<td>89.87 (14.44)</td>
<td>92.78 (11.27)</td>
<td>87.38 (16.55)</td>
</tr>
<tr>
<td>3. Defense attorney I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belief</td>
<td>56.54 (20.30)</td>
<td>57.78 (17.00)</td>
<td>55.48 (23.12)</td>
</tr>
<tr>
<td>Emotion</td>
<td>54.36 (22.98)</td>
<td>54.72 (21.04)</td>
<td>54.05 (25.03)</td>
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<tr>
<td>4. Prosecutor II</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Belief</td>
<td>74.10 (24.71)</td>
<td>73.33 (25.44)</td>
<td>74.76 (24.67)</td>
</tr>
<tr>
<td>Emotion</td>
<td>70.51 (25.59)</td>
<td>72.78 (26.08)</td>
<td>68.57 (25.85)</td>
</tr>
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<td>5. Defense attorney II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belief</td>
<td>39.62 (18.22)</td>
<td>38.33 (18.55)</td>
<td>40.71 (18.32)</td>
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<tr>
<td>Emotion</td>
<td>35.80 (21.83)</td>
<td>32.50 (19.42)</td>
<td>38.62 (23.80)</td>
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<td>6. Jury's verdict</td>
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<td></td>
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<tr>
<td>Belief</td>
<td>25.90 (19.26)</td>
<td>20.00 (15.62)</td>
<td>30.95 (20.95)</td>
</tr>
<tr>
<td>Emotion</td>
<td>22.41 (19.72)</td>
<td>16.11 (13.78)</td>
<td>27.81 (22.60)</td>
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<td>7. Appeal preparation</td>
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<tr>
<td>Belief</td>
<td>18.08 (15.42)</td>
<td>12.22 (10.46)</td>
<td>23.10 (17.36)</td>
</tr>
<tr>
<td>Emotion</td>
<td>16.20 (14.70)</td>
<td>10.83 (10.88)</td>
<td>20.81 (16.18)</td>
</tr>
<tr>
<td>Improvement</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belief</td>
<td>76.24 (21.81)</td>
<td>79.68 (24.19)</td>
<td>73.30 (19.66)</td>
</tr>
<tr>
<td>Emotion</td>
<td>79.10 (18.86)</td>
<td>83.45 (19.55)</td>
<td>75.38 (17.87)</td>
</tr>
</tbody>
</table>
of TBTR in helping patients to modify their negative CBs and to reduce self-criticism.

Conflicts of interest

The authors do not report any conflicts of interest. Trial-based cognitive therapy was developed by one of the authors (IRO). This research was not funded.

References

Dear Editor,

Anxiety is a manifestation with high prevalence in the population. The musical performance requires a high level of skills, making it susceptible to anxiety state. Studies show an alarming incidence of about 50% of music performance anxiety (MPA) among professional musicians. Literature data show a consistent difference between about 50% of music performance anxiety (MPA) among professional musicians1-4. Literature data show a consistent difference between about 50% of music performance anxiety (MPA) among professional musicians1-4. In the stress, there is a release of CRH in the hypothalamus, which determines an increase in the secretion of ACTH6-8. This study aimed to determine whether endocrine variables (cortisol and ACTH) could be related to gender differences in MPA.

The following inclusion and exclusion criteria were used: (Inclusion) – adult UFSJ (Sao Joao Del Rei Federal University) music students; (exclusion) – patients with a diagnosis or treatment of psychiatric diseases or uncompensated organic diseases. All the subjects completed and signed the Consent Term and Informed (TCLE), approved by the Ethics Committee of UFSJ. It was applied to version validated for the Portuguese language K-MPAI, which aims to establish scores for the MPA. The higher the score, the more suggestive MPA. Scores of the 4th quartile of this population were considered high (≥ 136). For the 28 subjects (14 + 14 larger smaller) polar distribution, were made the blood samples to measure cortisol and ACTH. The samples were collected between 08 a.m. and 09 a.m., and the patients were instructed not to smoke, eat, or drink alcohol within 12 hours before the collection. The reference values adopted for cortisol were 05–25 µg/dL and the plasma ACTH 06–76 pg/mL. Statistical analysis sought to establish relations between anxiety levels, gender and cortisol and ACTH. Parametric tests were applied.

The study population consisted of 140 subjects who met the inclusion criteria. There were 89 men (average K-MPAI = 106.70; s = 31.88) and 51 women (mean K-MPAI 109.03; s = 35.52). The average age of the study population was 24.8 years. There was no significant difference in scores of K-MPAI neither between the female and male groups nor in the lowest score group (14 students). However, in the highest score group (9 men and 5 women) the following pattern was detected: men presented a score in the K-MPAI significantly lower than women (♂ = 161 e ♀ = 145.5) (p ≤ 0.01). In relation to the hormonal dosages, it was demonstrated that, although the concentrations of both cortisol and ACTH were within the normal range (according to reference values), it was found that the ACTH concentrations in the highest K-MPAI score group were significantly higher in women (♂ = 20,3 e ♀ = 17,66) (p ≤ 0.05). On the other hand, serum concentrations of cortisol in the male group were significantly higher (♂ = 13,80 e ♀ = 14.68) (p ≤ 0.05) (Figure 1).

The results indicate that the ACTH possibly has a role related to the MPA. The discrepancy that occurred in relation to cortisol (Men > Women) could be explained as a function of the cortisol inhibit the HPA axis, with consequent inhibition of ACTH release in the male group5. It is expected that this study can contribute to initiatives aiming at the improvement of conditions in the psychic musical performance.

References

Dear Editor,

We report the clinical case where the sudden onset of a Cotard syndrome in a 69 year old lady lead to the discovery of a multifocal glioblastoma in the right temporo-parietal lobe.

Cotard's syndrome is a rare psychiatric disorder in which the afflicted patient believes he or she is dead. These nihilistic thoughts are the expression of a rare syndrome first described by Jules Cotard in late XIX century. The Cotard's syndrome has been studied and it seems that its psychopathology can be ascribed to the temporo-parietal cortex. Although the Cotard's syndrome is not part of the DSM-V it is common in psychiatric literature and is included in ICD-10-CM within code F22. It has been described associated with organic lesions and atrophy of the non-dominant temporo-parietal cortex, in pathologies like bipolar disorder, schizophrenia, subdural hemorrhage, multiple sclerosis, brain atrophy and cerebral infarction among others.

We observed the case of a female patient, 69 years old, with no relevant past medical history, that was admitted to the John Radcliffe Hospital in Oxford (UK) with an episode of numbness in the left hand and an episode of dizziness whilst at home, duration of symptoms was of 15 minutes and then resolved entirely. She had no history of head trauma. Neurological exam was unremarkable and the stroke team felt a CT scan was not required, however she failed occupational therapy assessment and was not sent home.

During the night she developed the delusion of being dead. When being interviewed, in the next day early in the afternoon, she stated:

- “I think I'm dead (...) it started during the night, like it was some kind of a dream, but this remain until now”
- “Do you rationally think you are dead?”
- “I do. It may not make much sense since I realize I have blood pressure when they measure it but I rationally think I am dead.”

No signs or symptoms of depression were apparent, she also denied any history of recent or not so recent affective or psychotic disorders. Moreover, her mini-mental state examination was unremarkable. Thus she seemed to have developed a type I Cotard syndrome. Cotard's syndrome is a uncommon neuropsychiatric condition in which the afflicted patient believes he or she is dead; the type I reflects the absence of depression, anxiety or hallucinations, it is closer to constitute a pure Cotard syndrome whose nosology may be more delusional than of an affective disorder.

A head MRI with Gadolinium was then performed that showed multifocal lesions within the brain likely in keeping with a primary brain tumor (Figure 1).

As stated in the MRI report:

“...There are multiple heterogeneously enhancing lesions within the right parietal lobe and superior temporal gyrus, which cross the midline just posterior to the splenium of the corpus callosum. These demonstrate mixed diffusion characteristics with predominantly restricted diffusion and low signal on gradient echo imaging consistent with necrosis. (...)”

Conclusion: Appearances are suggestive of neoplastic process with necrosis, most likely a primary glial neoplasm (multifocal GBM). Metastatic deposits remain within the differential but are less likely given the imaging characteristics.”

A chest/abdomen/pelvis CT scan showed neither primary tumor nor any metastatic disease. The patient was started on oral dexamethasone after the MRI result, as suggested by the neurosurgeon. As a result, the Cotard delusion disappeared in the following day. She was then discharged and referred to the neuro-oncology service. She undergone a brain biopsy a few weeks later which was consistent with WHO grade IV glioblastoma.

There is only one case reported in literature associating a brain tumor to this syndrome, it was published in 1993 and it tells the clinical case of a 12 year old boy with a parietal lobe astrocytoma. To the best of our knowledge this is the first reported case of a Cotard's syndrome caused by a brain tumor in an adult, and for obvious reasons, this seems to be the only known case where this syndrome...
was successfully treated by means of corticotherapy not requiring the normal approach with antidepressant and/or antipsychotic drugs.

This manuscript corroborates the assumption that one should keep a low threshold for organicity when finding a Cotard’s syndrome.

Conflict of interest
No conflicts of interest are reported.

References