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THE EFFECT OF TWO SESSIONS OF PBSP PSYCHOTHERAPY ON BRAIN ACTIVATION IN RESPONSE TO TRAUMA-RELATED STIMULI.THE PILOT FMRI STUDY IN TRAUMATIZED PERSONS

Efekt dvou sezení PBSP psychoterapie na aktivaci mozku v odpovědi na stimuly evokující trauma. Pilotní studie fMR u traumatizovaných osob.

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Abstract:

In our pilot study a group of 7 traumatized persons with symptoms indicating the need for psychotherapeutic intervention was investigated using functional magnetic resonance imaging (fMR) before and after a brief treatment program (2 days) using Pesso Boyden System Psychomotor (PBSP). PBSP is an innovative, mind-body psychotherapeutic method of emotional reeducation creating cognitive and emotional alternatives to traumatic memories.

The traumatic imagery procedure was performed by the visual presentation of specific trauma evoking figures selected by the patients prior to the treatment procedure and shown to them during the fMR scanning. After two sessions of PBSP we found decrease depressiveness (BECK, p£0.05) and a trend for improvement in trauma related symptoms (IES-R) and anxiety (SAS). We found that before PBSP treatment the pattern of brain activation (fMR) was similar to post-traumatic stress disorder: deactivation of anterior cingulate and frontal regions and activation of temporal cortex and insula. After two sessions of PBSP we found an increase of activation in anterior cingulate and thalamus and decrease in activation of temporal and insular cortex (SPM99, paired T-test, p£0.005 uncorr). These findings indicate that the PBSP intervention procedure increases the emotional competence of anterior cingulate

and increases the emotional information gating in the thalamus. These preliminary data demonstrate that PBSP therapeutic interventions improve the execution and control of emotional expression and behavior

Key words: functional magnetic resonance (fMR), Pesso Boyden System Psychomotor (PBSP), psychotherapy, trauma, cingulate, neuroimaging, PTSD, adjustment disorder.

Abstrakt:

V pilotní studii bylo ve skupině 7 traumatizovaných osob, které byli indikované pro psychoterapii provedeno vyšetření pomocí funkční magnetické rezonance (fMR) před a po dvoudenní terapií pomocí psychoterapeutického programu Pesso Boyden System Psychomotor (PBSP). PBSP je psychosomaticky orientovaná psychoterapie zaměřená na emoční reedukaci a tvorbu náhradních kognitivních a emočních alternativ k traumatickým vzpomínkám. Pomocí specifických trauma evokujících obrazů vybraných jednotlivými pacienty byla provedena vizuální stimulace během vyšetření fMR. Po terapii PBSP byl zjištěn pokles depresivity (BECK, p£0.05) a trend ke snížení příznaků spojených s traumatem (škála IES-R) a anxiety (SAS). Před terapií PBSP byl zjištěn vzorec aktivace fMR analogický posttraumatické stresové poruše: deaktivace předního cingula a frontálního kortexu a aktivace temporálního kortexu vč. insuly. Po terapii PBSP jsme zjistili zvýšení aktivace předního cingula a talamu a snížení aktivace temporálního a insulárního kortexu (SPM99, párový T-test, p£0.005 uncorr). Tyto nálezy svědčí pro skutečnost, že intervence pomocí PBSP zvyšuje kompetenci předního cingula a mediotemporálního kortexu v emoční regulaci s posílením hradlové funkce talamu. Tato pilotní data poukazují na skutečnost, že intervence pomocí PBSP zlepšuje kontrolu exprese emočního vyjádření a chování.

Klíčová slova: funkční magnetická rezonance (fMR), Pesso Boyden System Psychomotor (PBSP), psychoterapie, trauma, cingulum, zobrazení mozku, PTSD, porucha přizpůsobení.

Introduction:

The neurobiological and psychological effect of traumatic events is a fascinating area for research, from both the biological and psychotherapeutical point of view. Functional imaging brain techniques offer the unique possibility to determine the specific brain regions involved in the recall of traumatic events.

The neurobiological changes in the brain after exposure to traumatic events are mostly studied in the posttraumatic stress disorder (PTSD) as the model disease for traumatic etiology of psychiatric symptoms (Hull 2002). Using brain neuroimaging methods, the dysfunction was determined in PTSD patients in the limbic, paralimbic and prefrontal structures (Bremner et al., 1999; Hull 2002; Lanius et al., 2001; Liberzon et al., 1999; Osuch et al., 2001; Shin et al., 2001).

Less is known about the effect on brain activation after different treatment strategies as psychotropics or psychotherapy in traumatized subjects.

In our study functional brain imaging was used to determine brain regions activated by the visual presentation of specific trauma evoking pictures in the group traumatized persons. The subjects were diagnosed as PTSD or adjustment disorder according DSM IV classification.

The group of 7 previously traumatized persons with symptoms indicated for psychotherapeutical intervention was investigated by the functional magnetic resonance imaging (fMR) before and after the two day treatment using Pesso Boyden System Psychomotor (PBSP).

PBSP is an innovative psychotherapeutic method of emotional reeducation that applies successfully to a wide range of psychological and emotional problems (Pesso, Crandell, 1990). The PBSP method is based on symbolic satisfaction of a person's unmet developmental needs from early childhood — the needs for a sense of a place in the world, nurture, support, protection and limits. In PBSP traumatic events such as psychological, physical and sexual abuse are externally viewed and represented so that the their effect can be offset by newly constructed symbolic memories with the therapeutic aim of relieving symptoms (Pesso, 2005). PBSP treatment creates an alternative/antidote to traumatic memories by staging, with clients' active participation and control, carefully crafted, satisfying, sensory-motor, symbolic events that can be internalized, when necessary as: a) new, virtual memories with alternative, successful (non-damaging) endings – in contrast to the actual traumatic events, b) basic-need-satisfying, virtual memories cast as if they had happened in the past (constructed in line with the above-listed, innate expectations of satisfaction of maturational needs) for those clients who have experienced neglect in their childhood, c) Virtual memories that record the event and their relief as they view appropriate kinship figures taking on the responsibilities that they had unwittingly shouldered. When explosive, previously uncontrollable feelings of fear, rage and sexuality associated with these kinds of histories arise, PBSP procedures provide clients with the appropriate role-playing figures who offer behavioral interactions that help clients contend with each overwhelming state. For instance, the provision of a physical haven when they feel fear; physical constraints that keep them from damaging anyone or anything as they express their fury and physical limits to the feelings of either powerful sexual thrusting or sexual receptivity/vulnerability/openness that sometimes show up as uncontrollable trembling in the legs, thighs and pelvic area (Pesso, Crandell, 1990).

The primary aim of this pilot study was to detect the fMRI activation by the visual presentation of specific trauma evoking pictures before and after two PBSP sessions. The fMR scanning process was used as a non-invasive technique enabling the measurement of regional cerebral activation and thus elaborating dynamic functional maps of brain activity (Ogawa et al., 1992).

Methods:

Subjects and study design: The study population was recruited from psychotherapy clinics in Prague. The inclusion criteria were defined as previously traumatized persons with symptoms that required psychotherapeutic intervention. Five subjects included in this analysis agree with the DSM IV diagnostic criteria for adjustment disorder and two for the posttraumatic stress disorder (PTSD). The local ethics committee approved the fMRI study. 7 right handed healthy volunteers (2 males and 5 females), were investigated in the study. Median age was 28.5 years (IQR = 26.0-34.5), and mean education was 16.5

yrs (IQR= 12.0-20.0). The character of previous trauma was defined as capture (1), abortion (1), psychic abuse (4), and sexual abuse (1). The family and previous medical history of any psychiatric disorders was evaluated, along with a structured interview and physical examination and biochemistry investigation to exclude any mental or somatic disorders.

PBSP Method: The PBSP treatment was performed in two sessions within one week. The treatment began with providing the platform for work in PBSP called the Possibility Sphere, a safe psychological setting where all of the clients, feelings, thoughts and actions can emerge and arise without judgment or criticism. Afterwards the PBSP therapist (A.P.) carries out a process called Micro Tracking where the therapist assists the client in gaining greater awareness of their of their present consciousness. With the aid of externally posited, hypothetical figures called Witness and Voice Figures the therapist helps the client to become more consciously aware of their immediate and mercurial shifts of emotions and thoughts which are the basis for their moment to moment states of mind and the foundational background for their present and future choices and actions. The patterns arising from this scrutiny awakens clients' memories of important, life-influence events which have conditioned them to experience the present in a similarly dysfunctional manner. The memory of the situations in those events are externalized and represented in the therapy room with group members role-playing the significant figures "perceived" in the client's mind's eye and "reacted to" in their mind's body. Such scenes provide information/material for what "should have happened" in those past events that did not actually happen. The reversal of those negative conditioning events is staged with other group members role-playing what are called, Ideal Figures, who had they been back in the past would have brought need satisfaction, kindness and justice to those painful, deficit laden or traumatic experiences. The curative event is staged with the client in the center as the receiver of what "should have happened" at that earlier age with appropriately named care-givers, Ideal Mother, Ideal Father, etc. At the completion of that experience the client is assisted in internalizing that event as a virtual memory as if it happened in the past at the age when (according to genetic maturational expectations and anticipations) it "should have happened" with appropriate kinship figures. That is, not foster mothers or other substitutes but with what one intuitively anticipates would have come from one's biological care-givers. This positive, internalized, symbolic memory successfully competes with the original negative memory in producing attitudes and emotions more conducive to pleasure and satisfaction in present consciousness and states of being.

Psychometric measurement: To measure the intensity of symptoms derived form traumatic events we used the Impact of Event Scale (IES-R) (Horowitz, 1979), revised by Weiss & Marmar (1997). The IES-R is a self-report measure questionnaire to assess current subjective distress for any specific life event. The IES-R has 22 items (as „Pictures about it popped into my mind" or „I found myself acting or feeling as though I was back at that time"). To asses the depressiveness we used the Beck Depression Inventory-BDI (Beck et al., 1961). The anxiety level was evaluated by the use self-rating Anxiety Scale-SAS (Zung, 1971). Scales were administered at the day of fMR procedure and respondents were asked to rate each item in the scales according to the past 7 days.

Experimental task and fMRI procedures: The traumatic imagery procedure was performed by the visual presentation of specific trauma evoking figures selected by the patients. The patients were instructed to select the set of figures which are connected with the specific trauma and would evoke the traumatic memories. The patients were trained to remember the traumatic events as they see the pictures and monitor their emotions. These pictures were shown during the fMRI scanning presented by the use of an LCD projector placed outside the MRI scanner. The trauma blocks consist of pictures selected by the subject. The selection was based on the instruction that the pictures are invoking the previous trauma. The neutral (non-trauma) blocks, for comparison with the trauma evoking pictures, consisted of calm pictures without content involved in the characterized trauma. The contents and color schemes of rest pictures were selected as matching with the active conditions and controlled by the experimental subject as not evoking the specific trauma. Each condition was presented in blocks lasting 56 s, with eight pictures per block and an interstimulus interval (ISI) of 4 s. The experimental trauma condition alternated with the neutral condition, and four blocks of each condition were performed. FMRI imaging was performed on a 1.5-T Siemens Magnetom Vision (Siemens, Erlangen Germany) using a single-shot gradient echo EPI sequence (TR=4s, TE=54 ms, flip angle = 90 °) in 27 oblique slices of 4 mm thickness each. Sixty four T2*-weighted volume images were acquired during each measurement. The matrix size was 128 x 128, with a voxel size of 1.8 x 1.8 x 4 mm. Head movement was minimized by a forehead strap. Both fMR investigations were performed within 5 days before and after PBSP treatment.

fMRI data analysis: The data analysis was performed using SPM99 (http://www.fil.ion.ucl.ac.uk/spm) implemented in Matlab (Mathworks, USA). As a pre-processing step, the EPI images were realigned to the first one and all volumes were resliced with sinc interpolation. Mean images were created for estimating the normalizing parameters and the EPI volumes were then normalized into the same stereotactic space so that comparisons among subjects (multi-subject analysis) were possible. All volumes were smoothed with a full width at half maximum of 6 mm isotropic Gaussian kernel. Statistical analysis was performed to find regions that had a significant change (higher and lower) in signal during the trauma condition compared to the non-trauma condition and vice versa, for all individual subjects in the 1st level analysis. In the 1st level analysis the hemodynamic response was modeled with a boxcar function with a delay of 4 s and high pass filter (cut-off cycle was 136 s). Next, the estimated means of each condition were compared with a t-test in every voxel independently. To evaluate the group effect of trauma activation, the contrasts of individual evaluations were analyzed by the one sample t-test. The 2nd level (group) analysis for a population inference will be analyzed by paired the T – test separately for decrease and increase of the fMR signal in our experiment. The extent threshold consisted of 10 or more voxels, P-values ≤ 0.005 uncorrected for multiple comparisons at a single voxel level at each cluster level were used with a minimum of ten voxels over the threshold in both 1st and 2nd analyses

Statistics: Due to the sample size and rejection of normal distribution (Kolmogorov-Smirnov test) we used the nonparametric-paired Wilcoxon signed rank test to compare the results BECK, SAS, IES-R. Regarding the a priori formulated hypothesis that the low frequency would decrease the memory recall we used one-tail p values (confidence interval 95%).

Results:

After two sessions of PBSP we found decrease of IES-R from median 6.04 (IRQ=4.99 - 8.46) to 5 (IRQ=3.67 - 7.94) (p=0.055), BECK from 13 (ORQ=12 - 25) to 7 (IRQ=4.5 - 22.5) (p£0.05) and decrease of anxiety measured by SAS from median 51 (IRQ=37.5 - 63.5) to 40 (IQR=36.0-57) (p=0.054).

Brain activation during traumatic imagery before PBSP: Figure 1 shows regions with activation and deactivation during traumatic memory recall. We found that traumatic memories increased the fMR signal in superior temporal gyrus, posterior cingulate gyrus and precuneus in the left hemisphere and in the postcentral gyrus, insula, inferior parietal lobule and precuneus on the right side. The decreased signal was found in the right middle temporal gyrus, fusiform gyrus, inferior and medial frontal gyrus, precentral gyrus, putamen, globus pallidus and claustrum and the left superior parietal lobule, inferior occipital gyrus, thalamus, globus pallidus, inferior occipital gyrus and middle temporal gyrus.

Brain activation during traumatic imagery after PBSP: In the second session the fMRI signal was increased in superior temporal gyrus, lingual gyrus, insula, paracentral lobule, caudate, middle and inferior frontal gyrus on the left side and in Anterior and Posterior cingulate gyrus, claustrum, cuneus, precuneus, insula, medial and middle frontal gyrus, superior frontal gyrus and superior temporal gyrus. The signal was decreased on the left side in cingulate gyrus, fusiform gyrus, inferior frontal gyrus, inferior occipital gyrus, inferior temporal gyrus, lingual gyrus, middle frontal gyrus, middle occipital gyrus, middle temporal gyrus, precentral gyrus, Precuneus, superior frontal gyrus, superior parietal lobule and superior temporal gyrus. On the right side we found decrease of fMRI signal in cingulate gyrus, fusiform gyrus, inferior frontal gyrus, insula, middle frontal gyrus, middle occipital gyrus, parahippocampal gyrus, postcentral gyrus and superior frontal gyrus (Figure 1).

The difference between fMRI signal before and after PBSP: The contrasts of individual fMR evaluations in both conditions (before and after PBSP) were compared in the second level of SPM99 analysis by the use of paired t-test. We found significant increase of activation in left thalamus and right inferior frontal gyrus, middle temporal gyrus, medial dorsal nucleus of thalamus and anterior cingulate. The robust difference was found in the decrease of the fMR signal after PBSP investigation in left superior temporal gyrus, precuneus, middle Occipital gyrus, lingual gyrus, superior frontal gyrus, middle frontal gyrus, caudate tail, midline nucleus of thalamus, precuneus, thalamus, precentral gyrus, cuneus, lingual gyrus, and fusiform gyrus. The differences on the right side were found in the insula, fusiform gyrus, claustrum, middle occipital gyrus, inferior frontal gyrus, extra-nuclear, and caudate (Table 2, Figure 2).

Discussion:

In our study we detect that two sessions of PBSP therapy resulted in an improvement in depressiveness (BECK) and marginally significant was significant also the decrease in the subjective distress derived form traumatic events (IES-R) and anxiety (SAS). These findings indicate that the technique of brief (2 sessions) PBSP therapy is promising for the amelioration of trauma related symptoms.

The results in fMRI using symptom provocation paradigms before the therapeutic intervention offers the similar results as the previous studies focused on brain imaging in PTSD patients. Majority of studies

have implicated dysfunction in limbic and paralimbic brain regions in PTSD. Increased or altered cerebral blood flow has been observed in insula and decreased or absent activity has been seen in medial prefrontal and anterior cingulate cortex. These brain regions comprise a neural circuit that has been demonstrated as important for emotional processing and emotional regulation (Liberzon et al., 2003). The cingulate cortex is belonging to the limbic lobe and is functionally segregated. The anterior part has been characterized as executive in cognitive and emotional information processing, whereas the posterior region is characterized as "evaluative" (Bush 2000). In our study the traumatic memories evocation increased the fMR signal in posterior part of cingulate and decrease it in medial part of frontal cortex close to cingulate gyrus. These findings are consistent with previous reports in PTSD detecting the failure of activation in anterior cingulate (area 32), fusiform/inferior temporal gyrus, supramarginal gyrus, and visual association cortex (Bremner et al., 1999). Also Lanius et al. (2001) found that traumatized subjects with PTSD showed significantly less activation of the anterior cingulate gyrus, the thalamus, and the medial frontal gyrus (deactivated regions in our study) and moreover these region discriminate PTSD patients form traumatized subjects without PTSD. Another fMRI study suggested a diminished response in rostral anterior cingulate cortex in the presence of emotionally relevant stimuli in PTSD. The diminished recruitment of this region in PTSD may, in part, mediate symptoms such as distress and arousal upon exposure to reminders of trauma (Shin et al., 2001). |Theory of PBSP supposed that in trauma victims, the disturbing memories destabilize their emotional regulation. The scans prior to the clients' therapeutic sessions show an absence of normal emotional increase in the anterior cingulate and mediofrontal cortex. It is possible to speculate, that this finding demonstrates that these clients are unable to regulate or inhibit the emotions aroused by their traumatic histories and memories. The over activity in insular and temporal regions is evidence that this class of clients have higher emotional stimulation or outcome. This is in line with the histories of these clients and with the clinical histories of clients with similar difficulties.

After PBSP we found the increase of activation in anterior cingulate and thalamus. These increases should be interpreted as the result of PBSP which by the reconstruction of traumatic memories increases the emotional competence of anterior cingulate and increase the emotional information gating in thalamus.

The decrease of activation after PBSP was found in superior temporal gyrus and insula, regions closely related with emotional execution, which were activated in the before treatment investigation. Correspondingly, also antidepressant treatment of PTSD is connected with the significant deactivation in the left temporal cortex (Seedat et al., 2004). The decrease of activity in occipital regions may correspond to decrease of salience to visual presentation of emotional stimuli (Rauch et al., 1996). The PBSP process works with the awakening of verbal memories and their ability to awaken underlying processes of feeling that affect relationships and consciousness in the present. We assume that this process also puts that area of the mind under greater conscious control of the client.

Our pilot study has some methodological limitations. The sample size is too small to prove the clear clinical effect. The control non-treated group would be included into the study to evaluate the effect of

habituation. The group selection was based on the criterion for psychotherapeutical intervention and is diagnostically heterogeneous. Due to the explorative purpose we used the voxel level of p-values (0.005) for SPM99 uncorrected for multiple comparisons . Due to these reasons our findings would be confirmed in the extended study with the similar design.

Concluding, in our pilot study we found in traumatized subjects the pattern of the brain activation analogous to previous findings in PTSD: the failure of activation in anterior cingulate and frontal regions and activation of temporal cortex and insula. After two sessions of PBSP we found the increase of activation in anterior cingulate and thalamus and decrease in activation of temporal and insular cortex. Our preliminary data indicate that PBSP therapeutic intervention improves the control of emotional execution and enhances the cognitive functioning. Without the clients control of those processes the tendency to be over alert to body reactions to visual stimuli is expected. When the threatening external and internal worlds are attended to in PBSP antidotal interventions, clients anticipate far less dangerous internal and external environments.

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