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Comparison of Emotions and Difficulties in Emotion Regulation between Mild Traumatic Brain Injured and Healthy Participants

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Quantitative Study

Abstract

Background: Traumatic brain injury (TBI) is a common type of traumas and the most important cause of mortality in survivors of accidents in most countries. The inability to regulate positive and negative emotions is one of the features of head trauma. The present study was performed to compare positive and negative emotions and problems in emotion regulation between patients with mild TBI and healthy individuals.

Methods: In order to collect the required data, the Difficulties in Emotion Regulation Scale (DERS) and Positive and Negative Affect Schedule (PANAS) scale and a demographic characteristics questionnaire were used. After obtaining informed consents, the research procedure was performed by a clinical psychologist for the two groups. The 40 patients with TBI (75% men) were compared with the 40 healthy participants of the control group (75% men).

Results: Multivariate tests such as Hotelling's Trace showed significant differences between TBI and control groups (F = 4.883, P = 0.001, ES = 0.32). There were significant differences between the two groups in terms of the negative mood scale of the PANAS scale and the subscales of non-acceptance of emotional responses (NONACCEPT), difficulties engaging in goal directed behavior (GOALS) and limited access to emotion regulation strategies (STRATEGIES) and total score of the DERS.

Conclusion: The fact that there was no significant differences between the groups in the lack of emotional awareness (AWARE) and lack of emotional clarity (CLARITY) may show that people with mild TBI have some access to their emotions, but cannot regulate them. This study adds to previous knowledge by understanding emotions and emotional regulation strategies in patients with mild TBI. Some limitations of the present study and suggestions for future studies have been discussed in the present text.

Keywords: Traumatic brain injury, Affect, Emotions

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Introduction

Traumatic brain injury (TBI) is a common type of traumas and the most important cause of mortality in survivors of accidents (Lee, Seow, & Ng, 2006; Thurman, Alverson, Dunn, Guerrero, & Sniezek, 1999; Noppens, Brambrink, 2004). According to the 2003 report on disease control, the total cost of TBI in the United States was 56 billion dollars (Krug, Sharma & Lozano, 2000; Gerberding & Binder, 2003). Studies have estimated that 70 to 90% of brain injuries are mild (Bazarian, McClung, Cheng, Flesher, & Schneider, 2005). In Iran, we have accurate information about TBI and its burden. A study carried out in Kashan, Iran, estimated the incidence of TBI as 429 per 100000 people (Farzandipour, Ghatan, Mazrouei, Nejati, Agha Bagheri, 2007), according to this research, the incidence rate of TBI in Iran is higher than in Australia, France, Canada, Spain, and the US. The daily hospitalization cost for each patient was estimated at 316654 Rials in 2006. Another study reported that more than 10 billion Rials had been spent on the treatment of TBI in 2006 (Fakharian, Fazel, Tabesh, & Nabavi, 2007).

Previous researches have shown the high rate of psychiatric disorders in patients with brain injury (Rezaei, 2010; Whelan-Goodinson, Ponsford, Johnston, & Grant, 2009; Halbauer, Ashford, Zeitze, Adamson, Lew, & Yesavage, 2009). General estimations suggest that almost all patients after severe head trauma, more than half of patients after moderate head trauma, and about 10% of them after mild traumas will have long-term neuropsychiatric complications (Sadock, Kaplan, & Sadock, 2007). According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision (DSM-IV-TR), the two major groups of symptoms related to head trauma are symptoms of cognitive damage and behavioral effects. The major behavioral symptoms are personality changes, depression, and higher rates of impulsivity and aggression (Sadock et al., 2007). In addition, anxiety and depression have been reported as common outcomes of head injuries (Bay, Hagerty, Williams, & Kirsch, 2005; Wilz, 2007).

In general, the inability to regulate positive and negative emotions is one of the features of head trauma (Finset & Andersson, 2000; Schutz, 2007). Emotional responses provide important information about the experience of the individual in relation to others. With such information, humans learn how to behave in the face of emotions, how to verbalize their emotional experiences, what strategies to use in response to their emotions and how to behave toward others in terms of specific emotions (Cicchetti, Ackerman, & Izard, 1995).

On the other hand, several studies have shown that the ability of patients with head trauma to understand the emotions, motivations and thoughts of others, and subsequently, their behavior is significantly impaired (Bibby & McDonald, 2005; Martin & McDonald, 2005; McDonald & Flanagan, 2004; Turkstra, Dixon, & Baker, 2004; Henry, Phillips, Crawford, Ietswaart, & Summers, 2006). Emotion regulation, which in neurological terms is dependent on the prefrontal region of the cortex, affects the type, time and the way we experience and express our emotions (Cisler, Olatunji, Feldner, & Forsyth, 2010). A review of the psychological literature shows that emotion regulation is an important factor in health and in successful functioning in social interactions (Cicchetti et al., 1995). The lack of emotion regulation affects coping strategies, well-being and life satisfaction of the individual (Cicerone et al., 2005; Gordon et al., 2006). In addition, the emotional disorders of patients with head trauma have an important effect on the outcome of their rehabilitation (Gainotti, 1993).

Objectives

The present study was performed to compare positive and negative emotions and problems in emotion regulation between patients with mild TBI and healthy individuals.

Methods

This research is a case-control study. The study population consisted of all patients with mild head injury hospitalized in Shahid Beheshti Hospital in Kashan and healthy individuals in Kashan during April 2013 to December 2014. Based on the study by Cohen (1998), sample size was determined as 80 people (40 TBI patients and 40 healthy people). The participants were selected through convenience sampling. The inclusion criteria in the TBI group were having mild brain damage, Glasgow Coma Scale (GCS) score ≥ 13 and 18 to 70 years of age. The exclusion criteria in the TBI group were moderate to severe brain damage, substance dependency and having a mental disorder. The inclusion criterion in the control group was being 18 to 70 years of age. The exclusion criteria in the control group were substance dependency and having a mental disorder. A clinical psychologist referred to the neurology ward of the hospital, and after ensuring the patients' ability to respond, gave them the questionnaires. If patients had difficulty in reading or understanding the questions, they were provided with sufficient explanations. The individuals in the control group were selected from among the hospital staff, and the two groups were matched in terms of demographic characteristics (age, gender and years of education). Data were collected using a 3-part self-report questionnaire which consisted of 56 questions. The first part was a demographic information questionnaire (age, gender and etc.). The second was related to individuals' issues with emotion regulation and consists of 6 subscales and the third questionnaire was related to information about positive and negative emotions.

In order to complete the questionnaires, a clinical psychologist was present at the beside of patients with mild TBI who were able to respond. After effectively communicating with the patient and obtaining an informed consent, and when the patient was calm, the questionnaires were given to the patient to complete. If patients had difficulties in understanding the rules, the examiner simply explained them to the patient. In the control group, the rules were the same as those in the TBI group. After completing the questionnaires, the collected data were compared between the two groups.

Measures

Difficulties in Emotion Regulation Scale: The Difficulties in Emotion Regulation Scale (DERS) is a brief, 36-item self-report questionnaire designed to assess multiple aspects of emotional dysregulation (ED) (Tull, Gratz, Salters, & Roemer, 2004). Higher scores in this scale suggest greater problems with emotion regulation. The measure yields a total score (SUM) as well as scores on the 6 subscales of non-acceptance of emotional responses (NONACCEPT), difficulties engaging in goal directed behavior (GOALS), impulse control difficulties (IMPULSE), lack of emotional awareness (AWARE), limited access to emotion regulation strategies (STRATEGIES) and lack of emotional clarity (CLARITY). Items are scored based on a Likert scale ranging from 1 to 5. The items of the DERS have high internal consistency ($\alpha = 0.93$). Cronbach's alpha of the 6 subscales of the questionnaire has been reported, respectively, as 0.77, 0.71, 0.83, 0.49, 0.84, and 0.52 (Tull et al., 2004). The Content validity of the Persian version of the scale was confirmed by psychology experts and its reliability has been reported as 0.91 based on the alpha coefficient (Mirzaei, Gharraee & Birashk, 2014). In addition, the formal validity of the scale was confirmed by 5 clinical psychologists. Moreover, the reliability of the DERS in this research was obtained to be 0.90.

Positive and Negative Affect Schedule Scale: The Positive and Negative Affect Schedule (PANAS) questionnaire is a 20-item instrument developed for measuring both the negative and positive mood (Hughes & Kendall, 2009). Each subscale contains 10 items. Each item is scored based on a 5-point Likert scale. The

scale has good psychometric indexes. The alpha coefficient for the positive affect has been reported to range from 0.86 to 0.9 and for the negative affect from 0.84 to 0.87 (Hughes & Kendall, 2009). Content validity of the Persian version of the scale was confirmed by psychology experts and its reliability has been reported to be 0.87 based on the alpha coefficient (Khshipour & Dezhkam, 2006). Formal validity of the scale was confirmed by 5 clinical psychologists. Furthermore, the reliability of the PANAS questionnaire in this research was 0.82.

Statistical Analysis

Chi-square test was used to determine the significance of differences in gender, education level and marital status. Evaluation of the correlation between variables such as age, gender, educational level and marital status with the seven subscales of DERS and PANAS and total scores of DERS using bivariate correlation test showed that only age had a significant correlation with some scales of the DERS in the two groups. Therefore, age was the covariate in the multivariate analysis of covariance (MANCOVA) model. The data were analyzed in SPSS software (version 19, SPSS Inc., Chicago, IL, USA) using Kolmogorov-Smirnov and Shapiro-Wilk tests (for test of normality), chi-square test, the Pearson correlation coefficient test, and multivariate analysis of variance (MANOVA) (such as Levene's Test, Hotelling's Trace and Tests of Between-Subjects Effects). The significance level for the results of test of normality, chi-square test and MANOVA were 0.05 and for the Pearson correlation coefficient test was 0.05 or 0.01 (that have been brought below each related table in the results section).

Results

Table 1 shows the demographic data of subjects. Their ages ranged from 16 years to 78 years (Mean ± SD = 38.68 ± 14.44). There were no significant differences between subjects of the two groups in terms of demographic data. Table 2 illustrates the correlation between demographic variables and dependent variables.

Table 1. Distribution of traumatic brain injury and control group subjects according to their demographic characteristics

Variable	TBI N (%)	Control N (%)	P-value
Sex			0.62
Male	30 (75)	30 (75)	
Female	10 (25)	10 (25)	
Education level			0.57
Primary school	16 (40)	8 (20)	
Junior school	10 (25)	6 (15)	
Senior school	8 (20)	17 (42.5)	
≥ Bachelor	6 (15)	9 (22.5)	
Marital status			0.12
Single	10 (25)	5 (12.5)	
Married	30 (75)	35 (87)	

TBI: Traumatic brain injury; $P \leq 0.05$

Kolmogorov-Smirnov and Shapiro-Wilk tests showed that the distribution of scores is normal in the two groups ($P \leq 0.05$). Levene's Test of Equality of Error Variances did not show significant differences in the observed variances of the dependent variables except in the AWARE variable ($P > 0.88$).

Multivariate tests such as Hotelling's Trace showed significant differences between TBI and control groups ($F = 4.883$, $P = 0.001$, ES = 0.32). The means and standard deviations for the dependent variables of this study (positive and negative mood, NONACCEPT, GOALS, AWARE, STRATEGIES and CLARITY) and comparison of dependent variables in TBI and control groups (after controlling of age scores) are presented in table 3. There were significant differences between the two groups in the negative mood scale of the PANAS scale and NONACCEPT, GOALS and STRATEGIES subscales and total score of the DERS.

Table 2. The correlation between demographic variables and dependent variables in the two groups

	Sex	Age	Education	Race	Marriage	Positive	Negative	NONACCEPT	GOALS	AWARE	STRATEGIES	CLARITY
Sex	1	0.039	-0.132	-0.149	-0.018	0.129	-0.065	0.041	0.023	-0.130	-0.007	0.055
Age		1	-0.433**	0.034	0.364**	-0.258*	0.089	0.151	-0.003	0.226*	0.111	0.231*
Education			1	-0.199	-0.110	0.276	-0.101	-0.137	-0.181	-0.031	-0.200	-0.202
Race				1	-0.141	0.088	0.049	0.198	0.185	-0.027	0.146	0.071
Marital status					1	-0.140	0.068	0.031	-0.026	0.076	0.006	0.078

NONACCEPT: Non-acceptance of emotional responses: GOALS: Difficulties engaging in goal directed behavior; IMPULSE: Impulse control difficulties; AWARE: Lack of emotional awareness; STRATEGIES: Limited access to emotion regulation strategies; CLARITY: Lack of emotional clarity

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 3. Means, standard deviations and comparison of dependent variables in traumatic brain injury and control groups

	TBI	Control	Type III Sum of Squares	df	Mean Square	F	P-value
	Mean ± SD	Mean ± SD					
Positive affect	35.89 ± 6.89	35.67 ± 6.28	36.347	1	36.347	0.893	0.348
Negative affect	25.94 ± 7.04	22.04 ± 7.55	268.671	1	268.671	4.968	0.029
NONACCEPT	16.82 ± 5.85	12.47 ± 5.31	318.429	1	318.429	10.068	0.002
GOALS	15.30 ± 4.94	11.69 ± 4.56	290.101	1	290.101	12.862	0.001
AWARE	18.63 ± 5.91	17.20 ± 3.81	11.724	1	11.724	0.485	0.488
STRATEGIES	21.27 ± 7.09	15.30 ± 5.42	668.806	1	668.806	16.554	0.000
CLARITY	12.29 ± 4.37	10.30 ± 4.96	38.036	1	38.036	1.769	0.187
Total score of DERS	84.33 ± 16.5	66.97 ± 15.11	4946.250	1	4946.250	19.608	0.000

TBI: Traumatic brain injury; NONACCEPT: Non-acceptance of emotional responses: GOALS: Difficulties engaging in goal directed behavior; IMPULSE: Impulse control difficulties; AWARE: Lack of emotional awareness; STRATEGIES: Limited access to emotion regulation strategies; CLARITY: Lack of emotional clarity; DERS: Difficulties in Emotion Regulation Scale; df: Degrees of freedom

$P \leq 0.05$

This means that the TBI group had greater problems with acceptance of emotional responses, engaging in goal directed behavior, emotional awareness, access to emotion regulation strategies and emotional clarity. Moreover, they had greater problems with emotion regulation generally.

Discussion

In this paper, the comparison of positive and negative emotions and difficulties in emotion regulation were investigated. The hypothesis was that people with mild TBI differ from healthy individuals in positive and negative emotions and difficulties in regulating those emotions. Some of this hypothesis was approved in this paper. There was a significant difference between negative emotions in the two groups, but there was no significant difference in the positive emotions. This failure to find a significant difference in the positive emotions is consistent with some previous studies (Saunders, McDonald, & Richardson, 2006; Croker & McDonald, 2005; Hopkins, Dywan, & Segalowitz, 2002; Jackson & Moffat, 1987; McDonald, Flanagan, Rollins, & Kinch, 2003). This shows that people with mild TBI may have difficulties in experiencing and recognizing negative emotions, but not positive emotions. Perhaps the brain has two distinct neural pathways for positive and negative emotions. Consistent with this notion, Saunders, McDonald, and Richardson (2006) have stated: "TBI impairs neural structures and pathways important for the aversive-defensive motivational system, thus affecting the reactivity to unpleasant stimuli" (p. 229). They also stated: "TBI did not appear to disrupt the attenuating effects of pleasant material on the startle response. Thus, the results of this study lend partial support to the notion that the aversive and appetitive motivational systems involved in startle modulation have different neural bases" (p. 229).

In addition, failure to find a difference in positive emotions may have some implications for future interventions for people with mild TBI. Future interventions may emphasize more on the role of positive emotions. Clinicians may use positive emotions to help people with mild TBI to handle their lives more effectively. Researchers and clinicians tried to treat mild TBI in various aspects. Positive emotions may be incorporated in a multidisciplinary approach toward the treatment of mild TBI. For example, in a recent study, the role of a multidisciplinary approach toward the treatment of psychiatric symptoms of these patients was implied (Wicklund & Gaviria, 2013).

In addition, the role of age in this study was important. Age had positive and significant correlations with marriage, lack of emotional awareness (AWARE) and lack of emotional clarity (CLARITY), and negative and significant correlations with education and positive emotions. The fact that age is positively correlated with lack of emotional awareness is consistent with some previous studies (Saunders et al., 2006). Thus, it is important to take into account the role of age in future studies. Individuals with mild TBI may improve better with prompt intervention at younger ages. Consistent with this notion, Mosenthal et al. (2004) argued that older patients need more inpatient rehabilitation and have more problems than their younger counterparts. Furthermore, in another study, age and some other clinical and demographic variables were the strongest predictor variables in mild TBI (Jacobs et al., 2010).

In addition, in this study, there was a significant difference between the groups in terms of NONACCEPT, GOALS, IMPULSE and STRATEGIES. There was no significant difference between the groups in terms of AWARE and CLARITY.

It can be inferred from these findings that people with mild TBI may have limitations in terms of emotion regulation strategies and goal directed behaviors (NONACCEPT, GOALS, IMPULSE and STRATEGIES), but not AWARE and CLARITY. Individuals with

mild TBI may have some access to their emotions, but cannot regulate them. This conclusion is in contrast to some previous studies that have emphasized the role of awareness of emotions on emotion regulation. For example, in one study, data showed that making oneself aware of one's own emotions can attenuate emotional arousal related brain activation in the amygdala (Herwig, Kaffenberger, Jancke, & Bruhl, 2010). Further investigation of the relation between awareness and emotion regulation, especially in mild TBI, is required. These findings can also be related to methodological complexities such as sample size. Moreover, the use of the DERS in this study can explain these differences because a study reported that previous studies on DERS have mainly used normal populations with minimal impairment in emotion regulation (Fowler, Charak, Elhai, Allen, Frueh, & Oldham, 2014). In addition, the finding that the total score of DERS is significantly different between the two groups is consistent with the notion that the DERS is a total construct which has several components (Gratz & Roemer, 2004).

This study has some important implications for theory and practice of people with mild TBI. It is important to understand the experience and expression of positive and negative emotions in these patients. Furthermore, it is important to understand the emotional regulation strategies in people with mild TBI. Some studies have attempted to incorporate emotions in the therapy of mild TBI. For example, in a recent study, a pilot study was conducted to examine the effects of mindfulness stress reduction on symptoms of chronic mild TBI/postconcussive syndrome (Azulay, Smart, Mott, & Cicerone, 2013). This study adds to previous knowledge by understanding emotions and emotional regulation strategies in patients with mild TBI. It adds to our knowledge of the theory of emotional regulation. In addition, based on this study and other studies, we can improve our treatment strategies for patients with mild TBI.

The present study had some limitations. One limitation was the potential bias in this study which could have affected the results and conclusions. The conductors of the research may have had some biases in the cultural, social and etc. domains. In addition, in this study, the data collection tools were self-report questionnaires. Future studies can replicate this study by using more accurate measures such as eye blink or even functional magnetic resonance imaging (FMRI). FMRI has not yet been used generally in the studies on emotion regulation of patients with mild TBI, but it is used for some other aspects of these patients including working memory (McAllister et al., 1999; McAllister, Sparling, Flashman, Guerin, Mamourian & Saykin, 2001) and etc. Moreover, the order of receiving the questionnaires in this study may explain these differences. Patients with mild TBI may have some cognitive deficits that can impair their responding of measures. According to previous studies, cognitive impairments are not uncommon in mild TBI (Newcombe & Menon, 2013; Croall et al., 2014; Milman, Rosenberg, Weizman & Pick, 2005; de Boussard, Lundin, Karlstedt, Edman, Bartfai, & Borg, 2005). The number of participants in this study was somewhat low. With a bigger sample volume, the results of the study can alter. In addition, in this study, the female to male ratio was unbalanced and there were more male participants. The male to female ratio in this study is consistent with some previous studies (Cassidy et al., 2004). This can explain some of the differences between the results of this study and previous studies. The use of more balanced sampling distributions can render different results. Because of the low sampling distribution and unbalanced female to male ratio, these results should be generalized and interpreted with caution.

In sum, the aim of this study was to understand the similarities or differences of positive and negative emotions and

difficulties in emotional regulation between patients with mild TBI and healthy individuals. The results show that the two groups differed in terms of negative emotions, non-acceptance of emotions, goal directed behavior, emotional regulation strategies and difficulties in emotional regulation. The groups did not differ in terms of positive emotions, lack of awareness of emotions and lack of clarity of emotions. Some questions have remained unresolved: Which neural pathways are responsible for positive and negative emotions? Is there a difference for patients with mild TBI in recognizing their emotions and regulating their emotions? Can more accurate devices such as FMRI add to our knowledge of emotional regulation strategies in patients with mild TBI and their treatment? Is there the possibility of rehabilitating these patients through the use of positive emotions? Future studies may find the answers to these questions.

Conflict of Interests

Authors have no conflict of interests.

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