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The Relationship between Behavioral Inhibition and Activation Systems and Emotional Structure among Scleroderma and Control Group in Lorestan, West of Iran, During 2016-2017

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Abstract

Introduction: The term scleroderma describes the dermal hardening characteristic of a heterogeneous group of related disorders. Patients with scleroderma often experience elevated symptoms of psychological distress, determined by changes in physical appearance, pain, fatigue sensation, and difficult in daily life occupations. With regard to importance of psychological substructures in cure and treatment of scleroderma, we explored cross-sectionally the roles of two broad motivational systems that are thought to control levels of responsiveness to cues of threat and reward, the Behavioral Inhibition System (BIS) and the Behavioral Activation System (BAS), in patients with scleroderma and healthy people. In addition, this study examined the role of two distinct factors of emotion, positive (PA) and negative affect (NA) and relationship between BIS and BAS with these affects. **Methods:** 70 patients attending to an outpatient scleroderma clinic in Rahimi hospital in Khorramabad, and diagnosed as scleroderma cases by a rheumatologist and 70 other healthy subjects with the same age average and similar entry criteria were selected as comparison groups. The two groups completed three questionnaires including socio-demographic variables (gender, age, marriage, education, etc.) and self-report measures assessing PA and NA (Positive and Negative Affect Schedule) in addition to BAS/BIS scales. The means of variables in both groups were compared by independent T-test. **Results:** The activity of BIS in scleroderma patients was significantly higher than healthy the people ($P<0.05$); while BAS activity in the healthy people was significantly higher than the patients group ($P<0.05$). Also PA in the patients group was significantly correlated with BAS ($P<0.005$) and NA in the patients group was significantly correlated with BIS ($p<0.001$). On the other hand, in the control group PA was significantly correlated with BAS ($P<0.001$) and BIS ($P<0.005$), but no significant difference was observed in relationship between NA and BIS in the control group. **Conclusion:** Fundamental analyzing of neural/behavioral variables and affects in the study of scleroderma disorders is necessary.

Keywords: Scleroderma, Brain/Behavioral Systems (BBS), Behavioral Activation System (BAS), Behavioral Inhibition System (BIS), Positive Affect (PA), Negative Affect (NA

Introduction

Scleroderma is a chronic and debilitating autoimmune disease of the subgroup of connective tissue diseases that is derived from Greek's word "sclerosis" and is used to describe thinking and hardening of the skin (Black, Med 1993). The disease is not contagious and is not transferred from generation to generation. However, the disease is more likely the infection of some family members (Koenig and et al, 2008). The disease is a long-term and variable disorder that usually starts slowly and gradually becomes worse during several years. it has been proved that sometimes it progresses faster(Black and et al,1992).

There are two types of scleroderma disease: localized scleroderma and multiple sclerosis. In localized scleroderma, the changes are caused in specific areas of the skin and underlying tissues of that area (Barnett and et al, 1988). Localized scleroderma can be divided into two categories: type Morphaeus A and type Linnaeus A. multiple sclerosis causes the changes in the skin and parts of the internal organs. These organs include blood vessels, joints, digestive tract (esophagus, stomach, and intestines) and rarely lung, heart, kidney and

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muscles (Poormoghim and et al, 2000; Hachulla and Launay 2011; Tager and Tikly 1999; Bassotti and et al, 1997; Wollheim, 2005; Marie and et al, 2001).

Clinical symptoms of this disease have a wide range and can be limited to the skin and the under tissues or also include internal organs. The most common symptoms are as follows: common symptoms including fatigue (76%), joint stiffness (74%), the analysis of muscle strength (68%), pain (67%), sleep problems (66%) and less commonly weight loss and nausea. Skin symptoms include thickening and hardening of the skin, itching, swelling, wounds, and dents of fingertips and mucous problems and Raynaud's phenomenon. Sometimes the wounds are so progressed that cut off the fingers of the person. Fingers movement is limited in this disease and also the person cannot open his/her mouth fully. Involvement of internal organs cause many problems, including the problems of digestive system (Gastroesophageal reflux, early satiety, bloat, diarrhea), the problems of respiratory system (asthma, cough, chest pain, interstitial tissue of lung, pulmonary hypertension), impaired function of renal and blood pressure, the problems of cardiovascular system, sexual problems and the problems of musculoskeletal system (Tager and Tikly 1999; Bassotti and et al, 1997; Wollheim, 2005; Marie and et al, 2001; Sandusky and et al, 2009; Thombs and et al, 2008; Gündüz and et al, 2001; anosik and et ak, 1989; Steen and Medsger 2000; Foocharoen and et al, 2012; Bhadauria and et al, 1995; Mukerjee and et al, 2003).

Sometimes immunosuppressive drugs are used for treatment of this disease such as Methotrexate and Azathioprine and also the chemotherapy drugs such as Colchicine, Cyclosporine, and Corticosteroids. Oxygen therapy in the wound and the blockers of calcium channel are used in Raynaud's phenomenon (vasoconstriction of the fingers in the cold). The average survival from diagnosis is approximately 11 years and life expectancy of ten years is 55%. Deaths in the first 10 years of diagnosis are about 49.9%. The lack of care, skin symptoms, pain, joint problems and involvement of internal organs is caused the dysfunction and significant limitation of individual and social life of these patients. The result is the health reducing and quality of life (Hrqol) in these patients and the certainty of individual and psychological problems in their lives. However, the training of patients and increasing of their knowledge and the compassion of the medical team can have positive effects on the patient participation in the process of treatment and the quality improvement of their life. Although scleroderma causes pain and physical disability in patients' life, fear and misunderstanding can cause more distress than the disease (Postlethwaite and et al, 2010; Sapadin and Fleischmajer, 2002; Manno and et al, 2011; Medsger and et al, 1971; Al-Dhaher and et al, 2010; Ioannidis and et al, 2005; Philip and et al, 2004; Hoogs and et al, 2011; Rannou and et al, 2007; Spindler and et al, 2009; Watson and Clark, 1989; Strand and et al, 2007; Hamilton and et al, 2005; Strand Elin and et al, 2006; Pressman and Cohen, 2005; Chida and Hamer, 2008; Hobfoll, 1989).

An important question in this context is that what the relationship is between the positive and negative affection? In a group of theories, both positive and negative affections are independent of each other and can occur simultaneously in one person that shows they are not two ends of a continuum. Other theories say the two types of affections are two ends of a continuum and are replaceable into each other. The dynamic theory of affection to explain which in the deal with the stress reduced the consciousness degree of a person from his/her mood states significantly, so that the severe pain as a stress limits the mood experiences of the person. As a result, an increasing and inverse relationship are created between positive and negative affect, that can reduce the pain and stress by inducing the positive and negative affect ((Fredrickson and Joiner, 2002; Kratz, Anna and et al, 2007; Davidson and et al, 1999; Seidel and et al, 2010; Heponiemi,. 2004; Smits, 2006; Chang, 2007).

From the evolutionary perspective, any of the affections have special functions and are various aspects of the nervous system of biological mechanism in people. Biological studies have shown that the physiological mechanism is also different in experience of positive and negative affections (Mura and et al, 2012). For example, the negative affection is part of the Behavioral Inhibition System (BIS) or avoidance behavioral system that tries to remove a person from a situation where there is a risk. In contrast, positive affection is a part of the Behavioral Activation System (BAS) that will lead us into rewarding situations that are enjoyable. Two inhibition and behavioral activation systems are part of the neurobiological basis of behavioral and affection and as well as the motivational basis for individual differences in behavior, mood, and affection, that first were mentioned by Gary in 1993. The reflecting traits of activation system are impulsivity traits and the reflecting traits of inhibition system are the anxiety traits (Chang, 2007; Carver and White , 1994; Berkman and et al, 2009; Gray, 1987l Gray, 1990; Watson and et al, 1999; Knyazev, 2006; Knyazev, 2004; Meyer and et al, 1999; Tyrka and et al, 2007; Blair and et al, 2004; Schmidt and et al, 2008; Vermeersch and et al, 2009; Moser and et al, 1993; Maia and et al, 2012; Mura and et al, 2012; Müller and et al, 2012).

The results of several studies have shown that positive and negative affections, respectively, are related to inhibition and activation systems of behavior ((Müller and et al, 2012; Arat and et al, 2012; Kubzansky and et al, 1998; Moradi, 2011). The results show that inhibition and activation systems interact with the mood, play a very important role in information processing, especially information processing of emotional and are the determinant of depressed mood and anxiety states. In many studies; the attention deficit hyperactivity disorder in children (ADHD) and behavior disorder are the result of dysfunction of behavioral activation system; while increasing the activity of behavioral inhibition system is predictive of affective disorder. Also, the activity of behavioral and brain systems is used in prediction of substance (drug) abuse and conflict. According to Mayer's researchers and others in connection with

behavioral inhibition and the activation system with bipolar disorder, high BAS is a predictor of mania symptoms, while high BIS and low BAS are depressive symptoms (Kubzansky and et al, 1998; Moradi, 2011; Mansouri and et al, 2010; Campbell-Sills and et al, 2004; Mohammadi, 2008; Watson and et al, 1988; Crawford and et al, 2004; Bakhsi and et al, 2009; Beevers and Meyer 2002; Angelopoulos and et al, 2001; Malcarne and et al, 2007; Hooker and et al, 2008; Thombs and et al, 2008; Legendre ane et al, 2005).

Recent studies show a relationship between the activity of brain/behavioral systems & hormones. One of these researches is the relationship between the activity of behavioral activation system & behavioral inhibition system with very low weight at birth. Hypothalamic-pituitary-adrenal glands and Glucocorticoids are involved with very low weight at birth, and increasing the activity of hypothalamic-pituitary-adrenal glands and Glucocorticoids are associated with characteristics such as the reducing of willingness to vitality and existing behavior. In another study, adults with very low weight at their birth than their peers who had good weight showed the greatest behavior of inhibition. Also, evidence shows the relationship between sex hormones of steroid and the activity of brain/behavioral systems. The relationship between testosterone and components related to BAS such as the desire for excitement are included in the studies in this field. As a result, it is assumed that the BAS and the BIS explain a wide range of disorders (Legendre ane et al, 2005; Thombs and et al, 2007; Nietert and et al, 2005; Mouthon and et al, 2010; Del Rosso and et al, 2004; Hudson and et al, 2009l; Johnson and et al, 2006; Bijttebier and et al, 2000; Leventhal and et al, 2000; Benyamini and et al, 2000; Chapman and et al, 2006; Hirsch and et al, 2007).

The aim of this research was to inspect the activities of brain/behavioral systems and its relationship with emotions in patients with scleroderma and compared with healthy people. Since doctors usually concentrated focus on reducing negative emotions (feeling) in chronic diseases and often the reinforcing of positive affections is neglected in treatment, this research is effective in inspecting the role of positive and negative affections in the treatment of chronic diseases (Brummett and et al, 2005; Linley & Joseph, 2004; Gonzalez and et al, 2004).

Methods

This cross-sectional study was conducted on all the people who were referred to rheumatology clinic of Rahimi hospital with a diagnosis of scleroderma as the sample of the study. The study included 70 patients with the diagnosis of scleroderma, and 70 persons selected randomly as the control. The patients who had neurologic disorders previously were excluded. Then the programs related to the project were provided for them after getting the satisfaction of the patients and the control group. In this study, three questionnaires were used as follows:

- The questionnaire of general information of the participants in the study
- The scale of behavioral inhibition and activation systems (BIS/BAS scale)
- The scale of positive & negative affections (PANAS)

The first questionnaire included gender (male or female), age, marital status (single, married, divorced or widowed), education, occupation, duration of disease from diagnosis (for the patients), history of psychiatric problems (with the name of the disease if the answer is *yes*) and history of drug abuse (with the name of drugs consumed if the answer is *yes*). Also the patients were asked to mention the parts of the body (skin, vascular systems, digestive system, breathing system, sexual problems, kidney problems & blood pressure problems of the nervous system, hypothyroidism & dental problems) most affected by the disease. The second questionnaire included 20 self-report questions and two subscales: BIS subscale & BAS subscale. BIS subscale in this questionnaire includes 7 items that measures the sensitivity of BIS or responding to threat and anxiety when dealing with threatened signs. BAS scale includes 13 items too, that measures the sensitivity of BAS and includes three other subscales that are BAS-Drive (4 items), BAS-Reward (5 items) and BAS-Fun (4 items).

The items were rated on a four-point scale by the participant (from 1=completely disagree to 4=completely agree). Karver and White reported that internal stability of BIS subscale and internal stability of BAS subscale as 0.74 and 0.71, respectively. The psychometric properties of the personal version of this scale are reported by Mohamadi on Khorramabad students as desirable. Cronbach's alpha for the inhibition scale is equal to %74, and for other activation subscales as follows: Reward %73, Absorber %76 & research %66, respectively.

The third questionnaire was a self-evaluation tool of 20 points that is designed for measuring two aspects of mood, i.e., negative & positive affections. Each subscale has 10 points that are rated by the participants based on the five-point scale of Likert (1= very low to 5= very much). The overall range of scores for each subscale is 10 to 50. The score of positive affection comes from the total score of ten negative words and the score of negative affection comes from the total score of ten negative words. Reliability and validity of this scale

were reported by Watson & Clarke for internal consistency coefficients (Alpha's coefficients) being %88 for PANAS-P and %71 for PANAS-N. Test-retest reliability with 8-week interval was %68 for PANAS-P & %71 for PANAS-N.

The SPSS software was used to evaluate and analyze the data in the study was used. Before the data analysis, first the statistical method of Smirnov-Kolmogorov was used to analyze the normality of the date, and after confirming the normal condition of the describing, descriptive statistical methods (the average, standard deviation, percentage) were used. Finally inferential statistical methods (independent t-test) were used to compare the means between the groups.

Data analysis

This study was conducted on 138 people including 72 and 66 people in the control group. The percentage and frequency of the participants are provided in Table 1, marital status information in Table 2, education information in Table 3, Frequency and Percentage of Students' Job Status in Table 4, Frequency and percentage of disease duration in Table 5, history of psychiatric disorders in the two groups in Table 6, drug addiction in Table 7 and the involvement of different systems in the patient's group in Table 8. To compare the differences of BIS, BAS, positive affections, and negative affections between the patients group and the control group, the average scores were compared, and the results are reported in Table 9. As it can be seen, the average scores of the patients with scleroderma in BIS system is higher than the average scores of the healthy people and the difference was significant ($p<0.05$). On the other hand, the average scores of the patients in BAS system were lower than the average scores of the control group. This difference was significant in the drive and reward sub-scales ($p<0.05$) but there was not a significant difference between the patients and the control group in the fun sub-scale, which can be due to a low volume of samples. Also, the average scores of the patients on the scale of positive affection were lower than the average scores of the healthy people, and there was a significant difference between the two groups in terms of positive affections ($p<0.05$).

In this study, there was not a significant difference between the control group and the patients on the scale of negative affections. The relationship between behavioral inhibition and activation systems with positive and negative affections in the control group and the patient group was done by the correlation Matrix of behavioral systems with affections, and the results can be seen in Table 10. According to the results, there was a significant relationship between the positive affections in the patients group with the drive and fun subscales ($p<0.005$), but a significant relationship was not observed between positive affections and the reward sub-scale. Also, negative affections in the patients group with behavioral inhibition system had a significant relationship ($p<0.001$). In contrast, there was a significant relationship between positive affections and reward and drive sub-scales in the control group ($p<0.001$) but there was not a significant relationship between positive affections and fun sub-scale. In the control group, negative affections did not have a significant relationship with behavioral inhibition system but it had a significant relationship with the fun sub-scale ($p<0.005$).

Discussion

As mentioned above, problems and disability resulting from chronic and incurable disease reduces life quality of patients and causes the prevalence of anxiety and depression in them. In a study in 1993 conducted by the Rheumatology college of America as preventing factors of mental health in scleroderma patients on 94 patients, the results showed that low education level, low awareness, lack of satisfactory from social and medical supports, physical disability and the uncertainty of disease future are factors that have the highest relationship with mental state and reducing the quality index of life of scleroderma patients. Of those surveyed, %32 had the symptoms of generalized anxiety that had the highest relationship with patients' insight from the apparent changes of body, and whenever the patients had more apparent changes, they also showed more anxiety. Of those people, 30 percent were diagnosed with social phobia and 84 percent were worried about the future of the disease (Watson &Pennebaker, 1989; Voogt and et al, 2005; Lustman and et al, 1998; esperance and et al, 2007).

The role of BIS system in other diseases has been investigated in numerous studies. In 1390, a study for the first time in Iran compared brain/behavioral systems and mental health in addicts and normal people by doing research on 50 addicted participants (26 people to opium, 18 people to heroin and 6 people to opiates) and 50 normal participants. The results showed that the people who were in terminal poles of BAS & BIS systems were more likely at risk of developing pathological symptoms. There was a significant difference between addicts and normal people in both BAS & BIS systems which represents the difference of overcome status of their brain/behavioral systems. The results showed that BAS scores in addict people were higher than the scores of normal people, and BIS scores in the normal people were higher than the addicts while there was not any difference between the two groups from fight-or-flight system (Watson &Pennebaker, 1989; Voogt and et al, 2005; Lustman and et al, 1998; esperance and et al, 2007; Rustin & Larsen, 1997; Depue & Collins, 1999).).

The results of this study showed the increasing the activity of behavioral inhibition system in the patients with scleroderma in contrast with the healthy people. Although inspecting the activities of behavioral/brain systems in patients with scleroderma was not observed in

the literature, due to the high level of anxiety in these patients, this finding can be considered in line with the findings that have examined the relationship between anxiety and behavioral inhibition system. Studies on clinical and non-clinical samples show the positive relationship between anxiety symptoms and the sensitivity of behavioral inhibition system. These people have a lower tendency toward the rewarding positions and feel less pleasure and hope in life. This finding is consistent with researchers that reported the existence of depression in patients with scleroderma, and also it is consistent with the research that neuroticism is associated with increasing the sensitivity to punishment and negative affection. In general, these patients show more sensitive to new stimuli, stimuli with incentive inherent frightening and threatening situation that may lead to punishment or lack of reward. Also, the results showed low levels the activity of BAS in the people with scleroderma compared with the healthy people. This finding is consistent with researches that refer to high levels of depression and reducing the quality of life in these patients. Depression has been related to reducing reward activity and its result reduces the incentive to target stimulus.

The patients with high positive affections compared to the patients with low positive affections have more tendency to the understanding of their disease and desirable performance and inspecting the adaptive checking ways and will show better judgment of their disease. Increasing the desire of patients to positive exciting can be helpful in dealing with the harmful effect of disease, better treatment, facilitate providing support tools and patients' satisfaction of treatment team. As it has been proven in previous studies, the role of negative affections is associated with mental health of people. It should be noted that low positive affections with negative affections is responsible for many aspects of mental function in medical patients and increasing the positive affections, and patients must be familiar with mental and emotional benefits of this therapy through cognitive therapy and interpersonal therapies. In addition, studies show that the encouragement of patients to strengthen positive affections can lead to long-term changes in personality such as increasing the social performance and increasing the possibility of positive events.

Conclusion

Therefore, with efforts to reduce negative affections, doctors could consider a complementary therapeutic plan to strengthen and use positive affections for improving the quality of life in patients with scleroderma to increase the response to treatment and improvement of mental state in these patients.

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Table 1: Frequency and percentage of subjects and sex

percent	Abundance	gender	Grouping
77/8	56	female	**Patient**
13/9	10	male	
8/3	6	Unknown	
100	66	Total	
48/5	32	female	**control**
50	33	male	
1/5	1	Unknown	
100	66	Total	

Table 2: Frequency and percentage of marital status of subjects

percent	Abundance	Marital status	Grouping
76/4	55	Married	**Patient**
16/7	12	single	
2/8	2	divorced	
2/8	2	Widow	
1/4	1	Unknown	
57/6	38	Married	control
37/9	25	single	

1/5	1	Widow	
3	2	Unknown	

Table 3: Frequency and Percentage of Students' Education

percent	Abundance	Education	Grouping
12/5	9	illiterate	**Patient**
26/5	19	Elementary	
22/2	16	Tips	
26/4	19	Diploma	
5/6	4	Associate Degree	
5/6	4	Bachelor	
1/4	1	Bachelor MA	
1/5	1	Elementary	**control**
12/1	8	Tips	
22/7	15	Diploma	
6/1	4	Associate Degree	
22/7	15	Bachelor	
22/7	15	MA	
12/1	8	PhD	

Table 4: Frequency and Percentage of Students' Job Status

percent	Abundance	Job	Grouping
72/2	52	Unemployed	**Patient**
12/5	9	Employed	
9/7	7	Free	
4/2	3	Retired	
22/7	15	Unemployed	**control**
21/2	14	Employed	
24/2	16	Free	
22/7	15	Retired	
1/5	1	Unemployed	

Table 5. Frequency and percentage of disease duration

percent	Abundance	Duration of the disease	Grouping
45/8	33	Less than 5 years	**Patients**
34/7	25	5 to 10 years	
8/4	6	11 to 15 years old	
7	5	16 to 20 years	
2/8	2	21 to 25 years old	
1/4	1	More than 25 years	

Table 6. Frequency and percentage of history of psychiatric illness in subjects

percent	Abundance	History of psychiatric Diseases	Grouping
11/1	8	yes	**Patient**

88/9	64	No	
0	0	Yes	**control**
97	64	No	
3	2	Unknown	

Table 7. Frequency and percentage of drug use history of subjects

percent	Abundance	History of drug use	Grouping
0	0	yes	**Patient**
98/6	71	No	
1/4	1	Unknown	
4/5	3	yes	**control**
95/5	63	No	

Table 8. Frequency and percentage of organs in the patient group

percent	Abundance	System involved	Grouping
68/1	49	skin	**Patients**
62/5	45	Vascular system	
43/1	31	Digestive system	
47/2	34	breathing system	
62/5	45	Musculoskeletal system	
5/6	4	Heart system	
11/1	8	Genital system	
15/3	11	Kidney system	
19/4	14	nervous system	
8/3	6	Thyroid	
23/6	17	Mouth and tooth	

Table 9. Comparison of independent sample T test

The significance level	T	Degrees of freedom	Standard deviation	Average	Grouping	Scale
0/003	-3/07	129	2/22	10/52	Patients	**BAS Beauty subscale**
			2/36	11/75	control	
0/000	-5/56	124	2/44	15/19	Patients	**BAS Bonus subscale**
			2/15	17/47	control	
0/070	-1/82	130	1/48	9/78	Patients	**BAS Hobby subscriber**
			2/64	10/46	control	
0/016	2/44	118	3/05	19/94	Patients	**BIS**
			2/23	18/75	control	
0/000	-6/54	122	8/04	29/88	Patients	**Positive emotions**
			6/77	38/62	control	
0/098	-1/66	123	8/52	23/39	Patients	**Negative emotions**
			6/90	25/70	control	

Table 10. Correlation matrix of behavioral brain systems with emotions

BAS Hobby subscriber	BAS Bonus subscale	BAS Beauty subscale	BIS	Grouping	Emotion
0/300*	0/256	0/298 *	-0/178	Patient	**Positive emotions**
0/211	0/597 **	0/615 **	0/270*	control	

0/008	0/203	0/224	0/379 **	Patient	**Negative emotions**
0/249 *	0/088	-0/027	0/060	control	

* p < 0/005
** p < 0/001

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