A Comparative Study of the Effectiveness of Acceptance and Commitment Therapy and Transcranial Direct Current Stimulation on Anxiety, Depression, and Physical Symptoms of Individuals Suffering from Chronic Pain

Minoo Gueserse[1] , Alireza Zali[2], Saeid Hassanzadeh[3], Mohammad Hatami[4], Morvarid Ahadi

[1] PhD Candidate in Psychosomatic Medicine and Psychotherapy, Psychosomatic Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
[2] Professor of Neurosurgery, Functional Neurosurgery Research Center, Shohada Tajrish Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[3] Associate Professor, Department of Psychology, School of Psychology and Educational Sciences, University of Tehran, Tehran, Iran
[4] Associate Professor, Department of Psychology, Kharazmi University, Tehran, Iran
[5] Assistant Professor, Department of Psychology, East Tehran Branch, Islamic Azad University, Tehran, Iran

Corresponding Author: Minoo Gueserse; *Postdoctoral Candidate in Psychosomatic Medicine and Psychotherapy, Psychosomatic Research Center, Isfahan University of Medical Sciences, Isfahan, Iran*
Email: m.gueserse@gmail.com

Quantitative Study

Abstract

Background: The present research was conducted to compare the effectiveness of acceptance and commitment therapy (ACT) and transcranial direct current stimulation (tDCS) on anxiety, depression, and physical symptoms.
Methods: This research falls among semi-probationary plans, with a pretest-posttest design, two groups, and follow-up. The research statistical population included all male and female out-patients who referred to any treatment centers in Tehran, Iran, in the years 2019-2020 with a chronic pain complaint and received a definitive diagnosis of chronic pain by neurologists and rheumatologists. In order to establish 3 groups using targeted sampling method (considering the inclusion and exclusion criteria), 30 patients were initially selected, and then, 15 patients were placed in the first experimental group and 15 patients in the second experimental group randomly. The research tools consisted of the Beck Depression Inventory (BDI) (1961), Beck Anxiety Inventory (BAI) (1990), and Mcgill Pain Questionnaire (MPQ) (2007). Research data were analyzed using repeated measures ANOVA.
Results: The result of data analysis indicated that ACT and tDCS lead to a decrease in depression, anxiety, and physical symptoms. In addition, compared to tDCS, ACT had a more significant effect on reducing anxiety in individuals suffering from chronic pain ($P < 0.05$).
Conclusion: Both ACT and tDCS had a significant effect on improving depression, anxiety, and physical symptoms in people with chronic pain. ACT was also more effective in reducing anxiety. However, there was no significant difference between ACT and tDCS in influencing depression and physical symptoms.

Introduction

The experience of living with chronic pain is a unique experience. Individuals' perception of pain is influenced by physical, mental, and social variables (Dowell, Haegerich, & Chou, 2016). The International Association for the Study of Pain (IASP) defines it as an unpleasant emotional experience that accompanies actual or potential damages to tissues. Pain is basically categorized into 2 types of chronic and acute in terms of duration. Acute pain is described as pain that starts quickly and lasts for a short time. This type of pain has a protective role, informs the person of the damages, and makes him/her stay away from its stimulants. Symptoms of chronic pain are a prevalent problem and it causes some great challenges for therapists due to its complicated nature, vague pathology, and poor response to treatment (O'Connell, Marston, Spencer, DeSouza, & Wand, 2018). The physical symptoms of pain range from mild to severe pain that is not mitigated as expected and pain may appear in the forms of sudden, shooting pain, irritation, or ordinary pain or it might be like an electric shock, fatigue, heaviness, or congestion (Thompson, Antcliff, & Woby, 2018).

Researchers unanimously agree on this fact that chronic pain is one of the most prevalent and damaging chronic health issues. Chronic pain is a common health problem around the world and it severely affects the social and occupational living quality of the affected individuals (Kuner & Flor, 2016). The results of studies in Iran also indicate that this problem is highly prevalent and leads to psychological confusion (Boroumand, Asghari Moghaddam, Shaeeri, & Mesgarian, 2012).

One of the reasons for chronic pain being the most challenging issues in contemporary diseases is that it is accompanied by physical diseases and mental disorders. There are numerous epidemiological studies that support the high prevalence of major psychological disorders among those suffering from chronic pain. The most prevalent psychological disorders are said to be accompanied by chronic pain, depression (10 to 100%), anxiety (with a prevalence higher than depression), sleeping disorders, addiction to drugs (with a prevalence higher than that in the general population) (Fisher, Heathcote, Eccleston, Simons, & Palermo, 2018). Anxiety is associated with an unsafe concept or a threat that the individual cannot clearly identify its source and it is assumed as a threatening situation, under the influence of stimulations, whether internal or external, and the individual is unable to control them (Lerman, Rudich, Brill, Shalev, & Shahar, 2015). Depression disorder is the second most prevalent psychological diagnosis in such patients. Most such patients experience a period of denial and disappointment that are followed by the signs of depression and anxiety (Reiner, Bakermans-Kranenburg, Van IJzendoorn, Fremmer-Bombik, & Beutel, 2016).

Of the psychological treatments for chronic pain, we can refer to behavior therapy, psychoanalysis, biofeedback, gradual relaxation, and cognitive behavioral therapy (CBT). Presently, we are being presented with the third generation of such therapies. Instead of changing the cognitions in such therapies, it is attempted to improve the individual's psychological communication to his mind thoughts and emotions. One of the therapies that have lately come into careful consideration by researchers is acceptance and commitment therapy (ACT) (Trompetter, Bohlmeijer, Veehof, & Schreurs, 2015). Communication system theory is the basis for this therapy. Based on this theory, many of the solutions that we use to solve our problems confine us to some traps that irritate us. This therapy highly recommends avoiding pain and stress as the main problems for the patients, thus leading them to inability

and low satisfaction with life. According to this theory, avoidance takes place when negative emotions and thoughts leave inappropriate and excessive effects on behavior. Therefore, the main therapy method is ACT and confronting the patients with situations they are used to avoiding (Hughes, Clark, Colclough, Dale, & McMillan, 2017).

Contrary to other therapies (such as CBT) that emphasize on lowering or controlling the symptoms, ACT gives priority to an increase in acceptance of negative thoughts (thoughts, excitements, physical senses) in favor of involvement in significant activities that are impossible to change directly, though this may invite in a huge amount of pain and stress. ACT is aimed at improving the patient's performance through improvement of mental flexibility (Livheim et al., 2015).

Vowles and Thompson (2011) focused on the main processes of therapy based on acceptance and commitment and indicated that, compared to the outset of therapy, the patients had better physical and emotional performance and, compared to the initial follow-up, they had kept the therapy achievements more.

In recent years, researches on the efficiency of non-aggressive techniques for brain stimulation have increased (Arkan & Yaryari, 2014). Transcranial direct current stimulation (tDCS) is a non-aggressive method during which a poor direct current (1 to 4 milliampere) is applied through the skin of the head through which some long-term changes are made in the cortex axis in the depolarization and hyperpolarization of neurons. It also has some effects on neurotic receptors. In other words, in this type of electric stimulation, some parts of the head are targeted using a poor electric current (Sadock, Sadock, & Kaplan, 2009). In this method, 2 electrodes, one positive and the other negative, are placed on the head through a sponge pad that is wet with conductive solvent.

The electric current reaches the cortex level through these electrodes upon passing through various parts (skin of the head, skull, etc.). The current that reaches that area gives the neurons electric load, thus causing positive and negative poles that lead to a change in activity in that area (Akbari, 2015). Reviewing the existing resources showed no research in our country on the comparison of the effectiveness of ACT and tDCS in lowering anxiety and depression and physical symptoms of those suffering from chronic pain. Therefore, this research was conducted to make such a comparison, provide some background information for implementing psychological therapies in order to improve psychological confusion (anxiety and depression) and the physical symptoms of those suffering from chronic pain, and determine whether the effectiveness of ACT and tDCS on psychological confusion (anxiety and depression) and physical symptoms of those suffering from chronic pain differ from each other or not.

Methods

This research falls among the quantitative studies in terms of collected data, the applied studies in terms of goal, and semi-probationary plans in terms of type of pretesting, two-group follow-up, and manner and procedure. The research statistical population included all male and female out-patients who referred to any of the treatment centers in Tehran, Iran, in the years 2019-2020 complaining of chronic pain and received a definitive diagnosis of chronic pain by neurologists and rheumatologists. The sample included 30 patients. The sampling procedure in this research had 2 steps. First, through convenience sampling, a number of individuals were selected from among those diagnosed with chronic pain.

Table 1. Content of training sessions for indexes based on acceptance and commitment therapy (Iforth & Forsite, 2005)

Sessions	Content
1st session	Recognizing the nature of emotion, thoughts and actions, creating creative confusion, controlling one's internal experiences like negative thoughts, emotions, and negative emotions
2nd session	Examining getting used to avoidance of emotions, replacing experiences tendency (acceptance) with avoidance, preparing clients for mind awareness
3rd session	Changing clients' focus to internal experiences, practicing mind awareness and detachment cognition
4th session	Developing mind awareness and detachment cognition skills, practicing being aware of emotions along with discussing them, explaining the difference between clean and dirty
5th session	Providing an introduction to set up some effective goals related to values, putting forward and identifying one's values, explaining the difference between value and goal
6th session	Performing mind awareness and detachment cognition practices, putting forward a conceptualized self and self as a background, identifying action steps (small behaviors to reach bigger goals)
7th session	Mind awareness practices while walking, identifying behavior goals to reach values, fear algorithm for identifying the obstacles to reaching values
8th session	Teaching clients to be a therapist for themselves, explaining the difference between lapse and return, surface normalization of negative emotions, gradual progress and emphasizing on behavioral goals

Then, those who had the study inclusion criteria underwent a pretest and clinical interviews by the researcher under the supervision of a psychiatrist, and based on the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, (DSM-5) diagnosis criteria, 30 individuals (15 in each group) were selected from among the men and women who had gained the highest scores (at base line) on the questionnaires. The participants were randomly allocated to 2 intervention groups (15 in each group).

Transcranial direct current stimulation protocol: The tDCS protocol is a painless and safe method that is carried out by applying an electric current of 1 or 2 milliamperes within 20 to 30 minutes by electrodes fixed on the skull. This passing current adjusts the activation of a part of the cortex that is under the electrode and affects stimulation power and synapsis flexibility, and is specified by activating a part of the brain.

De-polarity current: At higher electric current, more effects are expected to be observed. However, the highest permitted current was 2 milliamperes because of the safety of those attending the test in this research.

Shape and size of electrodes: The density of the current passing through the skull is very important. In fact, current density represents the amount of current crossing each square centimeter of the electrode. In most previous studies, current density was regulated between 29%-08% of milliampere per square centimeter. Thus, the shape and size of the electrodes will be effective. In this research, 25 cm electrodes were used, and to achieve a good connection between the electrodes and the skull, a wet fabric pad immersed in salt water was placed over the electrodes.

Plan time and intervals between stimulation sessions: In this research, stimulation time was 20 minutes and the number of stimulation sessions was 12 during 6 weeks with intervals of 3 to 7 days.

Stimulation protocol: There were 2 active stimulation orbits and electrodes were placed in cz-f3-f4 as per standards 10-20. Cz situation is considered as reference (basic) situation. One of the activation channels between cz and f3 is activated. Sine wave is with a frequency of 10 Hertz and domain of 1 milliampere, along with negative cathode

current in size of 1 milliampere. One of the other activation channels between cz and f4 is activated. Shape of sine wave is with a frequency of 10 Hertz and domain of 1 milliampere, along with negative anode current, in size of 1 milliampere.

Beck depression questionnaire: The Beck Depression Inventory (BDI), 2nd edition (Stefan-Dabson, Mohammadkhani, & Massah-Choulabi, 2007), is compiled for measuring depression severity and is in conformity to the DSM-5 depression criteria. This questionnaire consists of 21 questions, each question is scored on a 4-point scale ranging between 0 and 3. The total score of the BDI ranges from 0 to 63 and high scores indicate more severe depression. The cut-off point of the BDI is 13. Its test-retest reliability is 0.93 and internal consistency through Cronbach's alpha is 0.91 (Nazari, Ahmadian, & Afshar, 2014). Likewise, examining the validity of structure is based on calculating convergent validity versus calculating correlation coefficient of scores resulting from second edition of the BDI version and depression scale of mild symptoms questionnaire that indicates a correlation equal to 0.873 (Stefan-Dabson et al., 2007).

Beck Anxiety Inventory: Aaron Beck et al. introduced the Beck Anxiety Inventory (BAI) that exclusively measures the severity of clinical anxiety symptoms. Each item is scored on a 4-point scale ranging from 0 to 3. Each item of the test describes one of the prevalent symptoms of anxiety (mental, physical, and fear symptoms). Therefore, the total score of this questionnaire falls within the range of 0-63. Its convergent coefficient (alpha coefficient) is 0.92 and its reliability with test-retest method with a 1 week interval is 0.75 and the correlation of its items ranges from 0.30 to 0.76 (Kaviani & Mousavi, 2008). In examining the psychometric qualities of this test in the Iranian population, the reliability coefficient, test-retest reliability, and Cronbach's alpha were reported to be about 0.72, 0.83, and 0.92, respectively.

McGill Pain Questionnaire: The McGill Pain Questionnaire (MPQ) was developed in 1997 by Melzak et al. and it has 20 sets that measure individuals' perception of pain in 4 different aspects (sensorial, emotional perceptions, pain assessment, and various pains). MPQ is among the most outstanding tools for measuring pain and was implemented for the first time by Melzak et al. on 297 patients suffering from a variety of pains. The MPQ includes two independent factors; one titled sensorial pain describes the individual experiencing pain and the other one is emotional pain that describes the emotional impression of experiencing pain. Dworkin et al. (2009) have approved the validity of this questionnaire. Moreover, its reliability was calculated using Cronbach's alpha; the alpha coefficient for all aspects was between 0.83 and 0.87.

Results

Descriptive indexes (standard average and deviation) for the scores of anxiety, depression, and physical symptoms, in the experimental groups and control group in the pretest and posttest steps are elaborated further in the following parts.

As can be seen, the average in the ACT group and tDCS group is lower in the posttest compared to the pretest. As is indicated in table 2, it can be inferred that ACT and tDCS lower anxiety, depression, and physical symptoms in those suffering from pain.

In order to examine the effects of ACT and tDCS on the scores of indexes for depression, anxiety, and physical symptoms in the pretest, posttest, and follow-up steps, mixed analysis of variance (ANOVA) was used (one factor inside testables and one factor between testables). The 3 steps of pretest, posttest, and follow-up were considered as testable internal factor and tested grouping in 3 groups as an inter-testable factor.

Table 2. The mean and standard deviation of indexes of anxiety, depression, and physical symptoms separated according to measurement step in groups

Group	Variable	Index	Pretest	Posttest	Follow-up
ACT	Depression	Standard deviation	32.67	23.27	22.7
		Average	4.45	5.12	5.23
tDCS	Depression	Standard deviation	34.80	27.33	26.80
		Average	5.70	3.83	4.71
ACT	Anxiety	Standard deviation	33.60	22.60	22.60
		Average	4.93	4.22	5.14
tDCS	Anxiety	Standard deviation	32.00	25.60	27.07
		Average	4.41	3.79	4.77
ACT	Physical symptoms	Standard deviation	41.53	33.73	31.80
		Average	3.27	3.10	3.36
tDCS	Physical symptoms	Standard deviation	40.13	35.47	35.07
		Average	3.07	3.96	2.69

In order to examine a significant difference among averages of indexes for depression, anxiety, and physical symptoms in the 3 groups in therapy three steps, initially variances homogeneity and sphericity assumptions were taken into consideration. The results are provided in table 3 and 4.

As can be seen, the variances equality assumption has been approved (P< 05.0).

Difference variance for all combinations related to groups (sphericity) should be equal. To examine this assumption, Mauchly's sphericity test was used the results of which are presented in table 4.

As can be seen, the sphericity assumption is not established (P< 05.0). Based on this, questions were selected in the test from the Greenhouse-Geisser standard to obtain a more accurate approximation. A summary of the results of mixed analysis of variance for intergroup factors and intragroup factors is provided in table 5.

The results presented in table 5 indicate that regarding the intergroup factor, the amount of F calculated for the effect of stages (pretest, posttest, and follow-up) at the level of 0.05 is significant for the 3 indexes ($P < 0.05$). As a result, there is a significant difference among average scores of pretest, posttest, and follow-up for scores of indexes for depression, anxiety, and physical symptoms.

The results of Bonferroni post-hoc test were used to examine the differences between averages in therapy steps. The results indicated a significant difference between scores for indexes of depression, anxiety, and physical symptoms in the pretest, posttest, and follow-up steps. Likewise, there were no significant differences between scores of indexes of depression, anxiety, and physical symptoms in the posttest compared to the follow-up; thus, there have been no significant changes in the scores of indexes of depression, anxiety, and physical symptoms in the posttest compared to the follow-up.

Considering the results presented in table 5, regarding interaction among steps and group factors, F quantity calculated for the effects of steps (pretest, posttest, and follow-up) between the two groups of ACT and tDCS in the level of 0.05 for anxiety indexes is significant ($P < 0.05$).

Table 3. Examination of the homogeneity of variances in the two groups using Levene's test

Variables index	Physical symptoms	Anxiety	Depression
F	0.07	0.45	0.86
Df 1	1.00	1.00	1.00
Df 2	28.00	28.00	28.00
P	0.78	0.50	0.36

Table 4. Examination of homogeneity of co-variances using Mauchly's sphericity test

Variables index	Physical symptoms	Anxiety	Depression
df	2	2	2
Mauchly's W	0.73	0.44	0.45
P-value	0.01	0.001	0.001

df: Degree of freedom

As a result, there is a significant difference between average scores of pretest, posttest, and follow-up of anxiety in the two groups. Likewise, considering the results presented in table 5 for intergroup factor, F quantity calculated in level of 0.05 for anxiety was significant (P < 0.05). Consequently, there is a significant difference between general average score of anxiety in the two groups of ACT and tDCS.

Discussion

The results of the data analysis indicate that ACT and tDCS led to lowering depression, anxiety, and physical symptoms. Moreover, ACT has had a more meaningful effect on lowering anxiety in those suffering from chronic pain compared to tDCS.

Regarding the effectiveness of tDCS on lowering depression, anxiety, and physical symptoms, it can be explained that in this method the right side of the forehead (especially the amygdala) is stimulated more in those suffering from chronic pain, while the left side of the forehead is less stimulated. Therefore, cathodal stimulation (preventive) of the right dorsolateral prefrontal cortex (DLPFC) led to a decrease in processing negative emotions and anodal stimulation (more activity) of the left DLPFC led to an increase in processing positive emotions, because the right hemisphere is mostly in charge of processing negative emotions and the left hemisphere is responsible for processing positive emotions.

Furthermore, the effectiveness of tDCS on depression is related to some other mechanisms. For instance, Wang, Zhu, Rehman, and You (2020) reported that stimulating the DLPEC led to a decrease in the relationship among the anterior cingulate cortex (ACC), the default mode network (DMN), insula, and DLPFC as well as reducing the relationship between the hyocamp and the substantia nigra (SN), and in this way, it improves functioning.

To explain more about the effectiveness of ACT, it should be noted that in ACT theory, it is emphasized that in mental health instead of focusing on eliminating pathogenic factors (Washburn, Yu, Rubin, & Zhou, 2021) the individual should be helped to accept his controlled emotions and perceptions and set him/herself free from verbal rules controlling that has caused problems, and thus, he/she is enabled to give up struggling with them.

Table 5. Mixed analysis of variance of scores for indexes of depression, anxiety, and physical symptoms using the Greenhouse-Geisser standard

Variable	Factors statistical index	SS	df	MS	F	P-value	ETA coefficient
Depression	Test (measurement repetition)	1583.62	1.29	1223.94	46.04	0.001	0.62
	Group test interaction	27.36	1.29	21.14	0.80	0.410	0.03
	Inter-group	86.04	100	86.04	2.035	0.140	0.08
Anxiety	Test (measurement repetition)	1396.96	1.29	1084.23	53.82	0.001	0.66
	Group test interaction	150.29	1.29	116.65	5.79	0.020	0.17
	Inter-group	298.84	100	298.84	8.09	0.010	0.22
Physical symptoms	Test (measurement repetition)	949.76	1.58	601.62	49.73	0.001	0.64
	Group test interaction	84.87	1.58	53.76	3.44	0.07	0.14
	Inter-group	32.40	100	32.40	2.52	0.120	0.08

SS: Sum of squares; df: Degree of freedom; MS: Mean of squares

During ACT, negative attitude toward the future and mental obsessions are changed to positive attitudes; in addition, ACT lowers anxiety level and improves individual independency. Furthermore, in ACT, the client learns through detachment cognition to see internal happenings as they actually are, not the way he interprets them. This eventually leads to better occurrence of acceptance procedure. This is due to the fact that detachment from emotions and thoughts weakens the performance of some internal processes such as some psychological obstacles. In situations where the individual experiences illogical and saddening thoughts regarding his/her problems, the only right move here is avoidance. With the help of detachment experiences, the client is helped to interact with his obsessive thoughts in a variety of ways. In this way, the level of belief in these thoughts is reduced, and therefore, the thoughts may exist to the same extent but occur in a different way. In fact, such thoughts are no longer threatening, because they are deemed only thoughts and not reality. Therefore, acceptance and commitment may lead to some positive changes in anxiety state through the combining of cheerfulness with seeing experiences clearly and accepting them.

Acceptance and commitment are an unbiased and balanced judgment of awareness that helps us to see clearly and accept emotions and physical phenomena just as they occur. Therefore, teaching such techniques to individuals helps them accept their emotional signs, and by accepting them, they pay less attention to such thoughts and they become less sensitive to them and it may improve their self-functioning. Likewise, teachings during the first and second sessions (including teaching mental flexibility, mental acceptance, mental awareness, and detachment cognition) are very helpful.

Teaching cognitive detachment provides patients with the opportunity to take a step back, look at their problems from a distance, and talk about them without difficulty and it helps them find and specify their real personal values and turn them into their special behavioral goals.

During the sessions that are focused on improving mental awareness, those under treatment re-evaluate their positive and negative thoughts and try to judge their problems accurately. Moreover, when an individual is not trying to reduce his thoughts and emotions, and gives up fighting with his emotions and thoughts and instead moves toward the goals he has set in life valuable directions, anxiety is significantly reduced.

Furthermore, as Darvish Baseri and DashtBozorgi (2017) stated, in this research, during ACT, the individuals were trained to improve their life status, reach personal values, eliminate less evitable problems, and thus, improve their health and mental well-being, by increasing their mental cognition of internal experiences instead of mental and practical avoidance of thoughts and social situations.

In fact, as Hayes, Strosahl, Wilson, and Lillis (2010) noted, active and effective confrontation with emotions, not avoiding, changing attitudes toward oneself and challenges, revising values and life goals, and commitment to a social goal are the main elements of this method.

Regarding the lasting effectiveness of ACT over time, it should be said that in line with previous researches, instead of teaching more or better strategies for changing or reducing unwanted emotions and thoughts, individuals are trained skills to find a way to see negative emotions and thoughts the way they are and this is what distinguishes ACT from other methods.

Brooks et al. (2021) stated that combining tDCS therapy with cognitive-behavioral methods leads to a significant reduction in stress and anxiety. Due to time and

execution limitations in the present study, it was not possible to simultaneously implement ACT and tDCS. In this research, only a questionnaire was used to collect information and due to execution limitations, interviewing for the collection of research data was avoided.

Researchers are recommended to use this research in patients suffering from other chronic pains and compare the results to the results of this research in order to be able to discuss the extent and effectiveness of the result with more confidence.

Moreover, tDCS and ADT can be implemented simultaneously in future researches and the extent of their effects should be compared to the results of the present research.

Conclusion

The results of this study showed that acceptance-based therapy and direct electrical stimulation have a significant effect on anxiety, depression, and pain. ACT) is more effective in reducing anxiety than tDCS. There was no significant difference between the effect of acceptance-based therapy and direct electrical stimulation on depression and physical symptoms.

Conflict of Interests

Authors have no conflict of interests.

Acknowledgments

None.

References

Akbari, F. (2015). The effectiveness of transcranial Direct Current Stimulation of the brain (tDCS) on reducing depressive symptoms among people with Depressive Disorder. *International Journal of Behavioral Sciences, 9*(1), 95-101.

Arkan, A., & Yaryari, F. (2014). Effect of transcranial direct current stimulation (TDCS) on working memory in healthy people. *Journal of Cognitive Psychology, 2*(2), 10-17.

Boroumand, A. , Asghari Moghaddam, M. A., Shaeeri, M. R., & Mesgarian, F. (2012). Chronic pain, pain self-efficacy and suicidal ideation: the moderating role of pain self-efficacy on relation between depression and suicidal ideation in chronic pain patients. *J Fundam Ment Health, 14*(2), 152-163.

Brooks, H., Oughli, H. A., Kamel, L., Subramanian, S., Morgan, G., Blumberger, D. M. et al. (2021). Enhancing cognition in older persons with depression or anxiety with a combination of mindfulness-based stress reduction (MBSR) and transcranial direct current stimulation (tDCS): Results of a pilot randomized clinical trial. *Mindfulness.(N.Y.),* 1-13. doi:10.1007/s12671-021-01764-9 [doi];1764 [pii]. Retrieved from PM:34630733

Darvish Baseri, L., & DashtBozorgi, Z. (2017). Effectiveness of group therapy based on acceptance and commitment on cognitive emotion regulation and alexithymia of patients with type 2 diabetes. *Iranian Journal of Psychiatric Nursing, 5*(1), 7-14.

Dowell, D., Haegerich, T. M., & Chou, R. (2016). CDC guideline for prescribing opioids for chronic pain--united states, 2016. *JAMA., 315*(15), 1624-1645. doi:2503508 [pii];10.1001/jama.2016.1464 [doi]. Retrieved from PM:26977696

Dworkin, R. H., Turk, D. C., Revicki, D. A., Harding, G., Coyne, K. S., Peirce-Sandner, S. et al. (2009). Development and initial validation of an expanded and revised version of the Short-form McGill Pain Questionnaire (SF-MPQ-2). *Pain., 144*(1-2), 35-42. doi:S0304-3959(09)00125-0 [pii];10.1016/j.pain.2009.02.007 [doi]. Retrieved from PM:19356853

Fisher, E., Heathcote, L. C., Eccleston, C., Simons, L. E., & Palermo, T. M. (2018). Assessment of pain anxiety, pain catastrophizing, and fear of pain in children and adolescents

with chronic pain: A systematic review and meta-analysis. *J Pediatr.Psychol, 43*(3), 314-325. doi:4034672 [pii];10.1093/jpepsy/jsx103 [doi]. Retrieved from PM:29049813

Hayes, S. C., Strosahl, K. D., Wilson, K. G., & Lillis, J. (2010). All Rivers Lead to the Ocean.

Hughes, L. S., Clark, J., Colclough, J. A., Dale, E., & McMillan, D. (2017). Acceptance and commitment therapy (ACT) for chronic pain: A systematic review and meta-analyses. *Clin J Pain., 33*(6), 552-568. doi:10.1097/AJP.0000000000000425 [doi]. Retrieved from PM:27479642

Kaviani H., & Mousavi, A. S. (2008). Psychometric properties of the Persian version of Beck Anxiety Inventory (BAI). *Tehran-Univ-Med-J, 66*(2), 136-140.

Kuner, R., & Flor, H. (2016). Structural plasticity and reorganisation in chronic pain. *Nat.Rev.Neurosci, 18*(1), 20-30. doi:nrn.2016.162 [pii];10.1038/nrn.2016.162 [doi]. Retrieved from PM:27974843

Lerman, S. F., Rudich, Z., Brill, S., Shalev, H., & Shahar, G. (2015). Longitudinal associations between depression, anxiety, pain, and pain-related disability in chronic pain patients. *Psychosom.Med, 77*(3), 333-341. doi:10.1097/PSY.0000000000000158 [doi]. Retrieved from PM:25849129

Livheim, F., Hayes, L., Ghaderi, A., Magnusdottir, T., Hogfeldt, A., Rowse, J. et al. (2015). The effectiveness of Acceptance and commitment therapy for adolescent mental health: Swedish and Australian pilot outcomes. *J Child Fam Stud, 24*(4), 1016-1030.

Nazari, A., Ahmadian, A., & Afshar, A. (2014). Diagnostic Clinical Features of Syndrome Dimensions of Psychological Trauma Resulting from Spouse Infidelity: A Qualitative Case Study. *Journal of Policing and Social Studies of Women and Family, 1393*(2), 71-84. Retrieved from http://pssw.jrl.police.ir/article_17571.html

O'Connell, N. E., Marston, L., Spencer, S., DeSouza, L. H., & Wand, B. M. (2018). Non-invasive brain stimulation techniques for chronic pain. *Cochrane.Database.Syst.Rev., 4*, CD008208. doi:10.1002/14651858.CD008208.pub5 [doi]. Retrieved from PM:29652088

Reiner, I., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Fremmer-Bombik, E., & Beutel, M. (2016). Adult attachment representation moderates psychotherapy treatment efficacy in clinically depressed inpatients. *J Affect.Disord, 195*, 163-171. doi:S0165-0327(15)30976-9 [pii];10.1016/j.jad.2016.02.024 [doi]. Retrieved from PM:26896809

Sadock, B. J., Sadock, V. A., & Kaplan, H. I. (2009). *Kaplan and Sadock's Concise Textbook of Child and Adolescent Psychiatry*. LWW medical book collection. Philadelphia, PA: Lippincott Williams and Wilkins Retrieved from https://books.google.com/books?id=DUFZ9NP2GK0C.

Stefan-Dabson, K., Mohammadkhani, P., & Massah-Choulabi, O. (2007). Psychometrics Characteristic of Beck Depression Inventory-II in Patients with Magor Depressive Disorder. *Rehabilitation, 8*, 80-86. Retrieved from http://rehabilitationj.uswr.ac.ir/article-1-135-en.html

Thompson, D. P., Antcliff, D., & Woby, S. R. (2018). Symptoms of chronic fatigue syndrome/myalgic encephalopathy are not determined by activity pacing when measured by the chronic pain coping inventory. *Physiotherapy., 104*(1), 129-135. doi:S0031-9406(17)30077-9 [pii];10.1016/j.physio.2017.07.005 [doi]. Retrieved from PM:28843450

Trompetter, H. R., Bohlmeijer, E. T., Veehof, M. M., & Schreurs, K. M. (2015). Internet-based guided self-help intervention for chronic pain based on acceptance and commitment therapy: A randomized controlled trial. *J Behav Med, 38*(1), 66-80. doi:10.1007/s10865-014-9579-0 [doi]. Retrieved from PM:24923259

Vowles, K. E., & Thompson, M. (2011). Acceptance and commitment therapy for chronic pain. In L. M. McCraken (Eds). *Mindfulness and acceptance in behavioral medicine: Current theory and practice* (pp. 31-60). Oakland, CA, US: New Harbinger Publications, Inc.

Wang, Z., Zhu, R., Rehman, A. U., & You, X. (2020). Dorsolateral prefrontal cortex and task-switching performance: Effects of anodal transcranial direct current stimulation. *Neuroscience, 446*, 94-101. doi:S0306-4522(20)30539-X [pii];10.1016/j.neuroscience.2020.08.020 [doi]. Retrieved from PM:32858145

Washburn, M., Yu, M., Rubin, A., & Zhou, S. (2021). Web-based acceptance and commitment therapy (ACT) for symptoms of anxiety and depression: Within-group effect size benchmarks as tools for clinical practice. *J Telemed.Telecare., 27*(5), 314-322. doi:10.1177/1357633X211009647 [doi]. Retrieved from PM:33966524