



# The Effectiveness of Acceptance and Commitment Therapy on Pain Acceptance and Pain Perception in Patients with Painful Diabetic Neuropathy: A Randomized Controlled Trial

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## ABSTRACT

**Introduction:** Neuropathic pain is a complex phenomenon in patients with diabetes. These patients have many problems, such as psychological problems, high-level pain perception, and pain acceptance. This study aimed to evaluate the effectiveness of acceptance and commitment therapy on pain acceptance and pain perception in patients with painful diabetic neuropathy.

**Methods:** This study was performed according to the clinical trial method. The sample size was 50 participants. In this study, participants were divided into interventional and control groups. According to the diagnosis of neurologists, all participants received conventional medications to manage neuropathic pain. The intervention group received acceptance and commitment therapy for eight sessions. The results in the three phases of pre-test, post-test, and follow-up

were evaluated. After completing the study, to comply with ethical standards, the control group received psycho-education. The tools used were the McGill Pain Questionnaire (MPQ) and the Chronic Pain Acceptance Questionnaire (CPAQ). Statistical analysis includes mean, standard deviation, and repeated-measures (ANOVA) conducted by SPSS software version 22.

**Results:** The results demonstrated that in the post-test and follow-up phases, acceptance and commitment therapy could improve pain acceptance and reduce pain perception in the intervention group compared to the control group ( $P < 0.01$ ).

**Conclusion:** The results indicated that acceptance and commitment therapy could be used as a psychological intervention besides pharmacotherapy to improve pain acceptance and reduce pain perception in patients with painful diabetic neuropathy.

**Clinical Trial Registration:** This study was registered at the Iranian Registry of Clinical Trials (IRCT20180205038630N4).

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**Keywords:** Acceptance and commitment therapy; Pain acceptance; Painful diabetic neuropathy; Pain perception

## Key Summary Points

### Why carry out this study?

Patients with painful diabetic neuropathy endure severe and excruciating pain that adversely affects their function. According to Melzack theory, one of the most important factors in pain perception is psychological factors.

Before this study, no clinical trial study had been performed to measure the effectiveness of psychological therapy in reducing the severity of pain perception in patients with painful diabetic neuropathy.

The main purpose of this study was to investigate the effectiveness of acceptance and commitment therapy (ACT) therapy on improving pain acceptance and subsequently reduction of pain perception.

### What was learned from the study?

The results showed that compared to the control group, the interventional group had significant improvement in pain acceptance and also a major reduction in pain perception in the post-test phase. The same results were observed after a 3-month follow-up.

## INTRODUCTION

Pain is a multidimensional phenomenon that can affect different aspects of one's daily functions. Interdisciplinary approaches to pain concentrated on the biopsychosocial model. This model emphasizes psychological factors in pain perception, such as thoughts, emotions, and behaviors [1–3]. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), pain disorders form an independent classification of psychiatric disorders. Chronic pain is considered in other illnesses such as

diabetes, fibromyalgia, rheumatism, migraine, and somatic symptom disorder [3, 4].

Painful diabetic neuropathy (PDN) diagnosis is based on the patient's description of pain, such as burning, deep aching, or sharp sensation. PDN is caused by dysfunction in nerve fibers. Neuropathic pain is usually severe and chronic and can negatively affect the biological and psychological functions of patients with diabetes. The estimated rate of PDN prevalence is 25–30% [5–8].

Different bio-physiological (acupuncture, laser therapy, and pharmacotherapy) and psychological (mindfulness and cognitive behavioral therapy) approach for pain management used [9–11]. The treatment at the forefront for neuropathic pain is pharmacotherapy, especially pain sedatives, opioids, cannabis, and antidepressants. All of them have significant side effects [12–14]. According to Melzack's theory, psychological factors might affect pain severity perception, and pain could exist despite typical clinical examination results [15, 16]. Kioskli et al. in a systematic review, indicated that depression, anxiety, poor sleep, and low quality of life are consequences of PDN [17]. Various studies on chronic pain show that acceptance might improve pain management [18–20]. McCracken has described pain acceptance as experiencing chronic pain without trying to eliminate or avoid it [19–21].

Cognitive behavioral therapy (CBT) is one of the psychological therapies for chronic pain. The aim of the CBT approach is the identification and alteration of thought content [18, 22–24]. In recent years, the third-wave of cognitive behavioral therapies used for psychological disorders. These interventions of CBT have beneficial for pain management in chronic pain patients. One of the third-wave of cognitive behavioral therapies is acceptance and commitment therapy (ACT), which emphasizes acceptance and willingness to experience unpleasant events. The aim of ACT is facing, acceptance, and change the patient's relationship with pain experience and psychological flexibility.

Research results about chronic pain, show that ACT increases pain acceptance and decreases pain perception, and pain severity

[20, 25, 26]. According to Xianghua Xu's (2019) study on pain acceptance in cancer patients with chronic pain, acceptance-based CBT could increase tolerance and reduce pain perception [27].

Furthermore, studies show that there is a negative correlation between pain acceptance and pain perception [28]. McCracken argues that pain acceptance consists of two elements: pain willingness and activity engagement. Pain willingness refer to strategies for adaption and coping with pain. Activity engagement emphasizes continuing daily activities and taking actions towards values despite focusing on the unpleasant experiences of pain [24, 28, 29]. The previous biological treatments for neuropathic pain had limitations such as being unable to the assessment of psychological factors affecting pain, and the proper literature review of ACT, in chronic pain. This study aims to assess the effectiveness of ACT (focusing on the acceptance component) in a sample of patients with PDN.

## METHODS

### Trial Design

The present study is a randomized controlled trial that includes the pre-test, post-test, and 3-month follow-up stages. The intervention was parallel in both groups and performed simultaneously.

### Participants

This was a single-blind randomized clinical trial conducted in the control group and intervention group. Moreover, pre-test and post-test design with a follow-up of three months used. The study population consisted of all patients diagnosed with diabetic neuropathy by a neurologist referred to the Psychiatric Clinic of Farabi Hospital, Kermanshah, Iran, between 15 April 2019 and 31 May 2019. The first step was the examination of patients with diabetes and neuropathic pain performed by a neurologist, and they were referred to a clinical psychologist

in the psychiatry clinic at a university-affiliated hospital. The study inclusion criteria were those diagnosed with diabetic neuropathy by a neurologist on the basis of a clinical status examination, a patient's informed consent to participate in the study, age range of 35–65 years, having at least third-level middle school education, no psychiatric treatment during the previous year, no history of alcohol and drug abuse, and no history of somatoform disorders [30, 31]. Participants excluded from the study on the basis of the following criteria: drug abuse during the intervention and follow-up, those who were absent for more than two sessions, and the patient's unwillingness to continue the treatment. Participants signed a consent form. Finally, they entered the treatment program and were assessed in the pre-test phase.

### Therapeutic Interventions

This study was conducted by a therapy program based on the theoretical model of acceptance and commitment therapy for chronic pain [20]. It consists of eight sessions a week (Table 1).

### Measures

#### *Demographic Characteristics Questionnaire*

This questionnaire consists of demographic variables such as age, sex, marital status, educational level, and job status.

#### *McGill Pain Questionnaire (MPQ)*

Melzack developed the MPQ in 1975. It consists of 20 subcategories of verbal (single-word) pain descriptors. The Short-Form McGill Pain Questionnaire (SF-MPQ) was also developed by Melzack et al. to provide a brief, but useful measure of pain used in 250 studies. The McGill Pain Questionnaire consists of two independent factors: the first factor is sensory pain describing an individual's experience of pain, and the second one is the emotional pain describing the psychological consequences of it. The reported Cronbach's alpha coefficient is 0.85% [32–34].

**Table 1** A summary of the contents of ACT sessions

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<i>A preliminary session</i>	Familiarizing with the participants, establishing a proper relationship to fill in the questionnaires appropriately, and building trust and conducting the demographic questionnaire and a pre-test survey
<i>Session 1</i>	Introducing the therapist and establishing a therapeutic relationship; an introduction to ACT and its objectives; defining the rules governing the therapy sessions; providing information about chronic pain and the different types of it and reviewing the relevant treatments and their costs and benefits
<i>Session 2</i>	Reviewing the material covered in the previous session and getting feedback from patients; discussing and evaluating their experiences; assessing a person's willingness to change; investigating patients' expectations of ACT; creating creative hopelessness and summarizing the material discussed at the session and giving assignment
<i>Session 3</i>	Reviewing the material covered in the earlier sessions and getting feedback from patients; identifying inefficient control strategies and understanding their uselessness; explaining the concept of acceptance and its comparison with the concepts of failure, despair, denial, resistance; discussing problems and challenges in the acceptance of the disease; concluding the material discussed at the session and investigating exercises for next session and giving assignment
<i>Session 4</i>	Reviewing the material covered in the earlier sessions and getting feedback from patients; behavioral commitment; introducing and understanding the conceptualized self and dissociation; applying cognitive defusion techniques; intervention in the functioning of the problematic chains of language and metaphors; summarizing the material discussed at the session and investigating exercises for next session and giving assignment
<i>Session 5</i>	Reviewing the material covered in the earlier sessions and getting feedback from patients; observing self as context; weakening self-conceptualization; in the therapy exercises, participants learn to focus on their activities such as breathing and walking and become aware of their senses at any moment and they are observed without judgment when emotions, feelings, and cognitions are processed; summarizing the material discussed at the session and investigating exercises for next session and giving assignment
<i>Session 6</i>	Reviewing the material covered in the earlier sessions and getting feedback from patients; identifying patients' life values and focusing on these values and paying attention to their power of choice; using mindfulness techniques with an emphasis on living in the present moment; summarizing the material discussed at the session and investigating exercises for next session and giving assignment
<i>Session 7</i>	Reviewing the material covered in the earlier sessions and getting feedback from patients; assessing each person's values and deepening the previous concepts; describing differences between values, goals, and common mistakes in value choice; identifying the internal and external barriers to following the values
<i>Session 8</i>	Understanding the nature of willingness and commitment (training commitment to action); identifying value-driven behavior plans and creating a commitment to them; tips for the concept of relapse and preparedness to cope with it; reviewing assignments and summarizing sessions accompanied by participants; sharing experiences with therapists and achievement expectations that were not met

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### **Chronic Pain Acceptance Questionnaire (CPAQ)**

The CPAQ is an assessment tool for chronic pain that each subject should answer for every item using a 7-point Likert scale. Each item scored on a 7-point Likert scale, ranging from 0

(never) to 6 (always), and the items for pain satisfaction scale scored reversely, ranging from 0 to 120. Higher scores indicate higher levels of pain acceptance. The Persian version of the CPAQ also showed adequate psychometric properties. The assessment of the psychometric

properties of the Persian version showed that the CPAQ had a Cronbach's alpha of 0.89 and test-retest reliability of 0.71 [35, 36].

### Randomization

The sample size calculation was obtained from the following formula [37]:

$$\frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 (s_1^2 + s_2^2)}{(\bar{X}_1 - \bar{X}_2)^2}$$

where  $\alpha = 0.05$ ,  $\beta = 0.08$ ,  $s_1$  is the standard deviation of the first community,  $s_2$  is the standard deviation of the second community,  $\bar{X}_1$  is the average of the first community, and  $\bar{X}_2$  is the average of the second community.

This study was conducted according to the clinical trial method. The sample size was 50 participants. In this study, participants were divided into the interventional group ( $n = 25$ ) and control group ( $n = 25$ ). In accordance with the diagnosis of the neurologist, all participants received conventional medications to manage neuropathic pain. The intervention group received acceptance and commitment therapy for eight sessions. The results in the three phases of pre-test, post-test, and follow-up were evaluated. At the beginning of treatment, after completion of treatment, and a follow-up period of 3 months, the pain acceptance and pain perception questionnaires were administered.

Prior to the study, a therapy process familiarization session was conducted to justify the patients.

### Statistical Methods

Statistical analysis and generation of descriptive statistics (e.g., frequency, mean, standard deviation) and inferential statistics (e.g., repeated-measures test ANOVA) were performed by SPSS software version 22.

### Ethical Considerations

Ethical issues and the study were explained to the study participants. All participants signed a

consent form before the initiation of the research and were assured that their identities and information would be kept confidential. The tools were filled in anonymously, and an ID code used to maintain the confidentiality of personal information. The research ethics committee of Kermanshah University of Medical Sciences approved the study (IR.KUMS.-REC.1397.939). This study was registered at the Iranian Registry of Clinical Trials (IRCT20180205038630N4). The study was conducted in accordance with the Helsinki Declaration of 1964 and its later amendments.

## RESULTS

Three patients in the intervention group were excluded because of unwillingness to participate in the study. Two other persons were excluded because of disease severity. In the control group, two patients were excluded because of illness severity, and two persons did not participate in the follow-up period; therefore, a total of 41 subjects participated. Figure 1 shows the flowchart of the study.

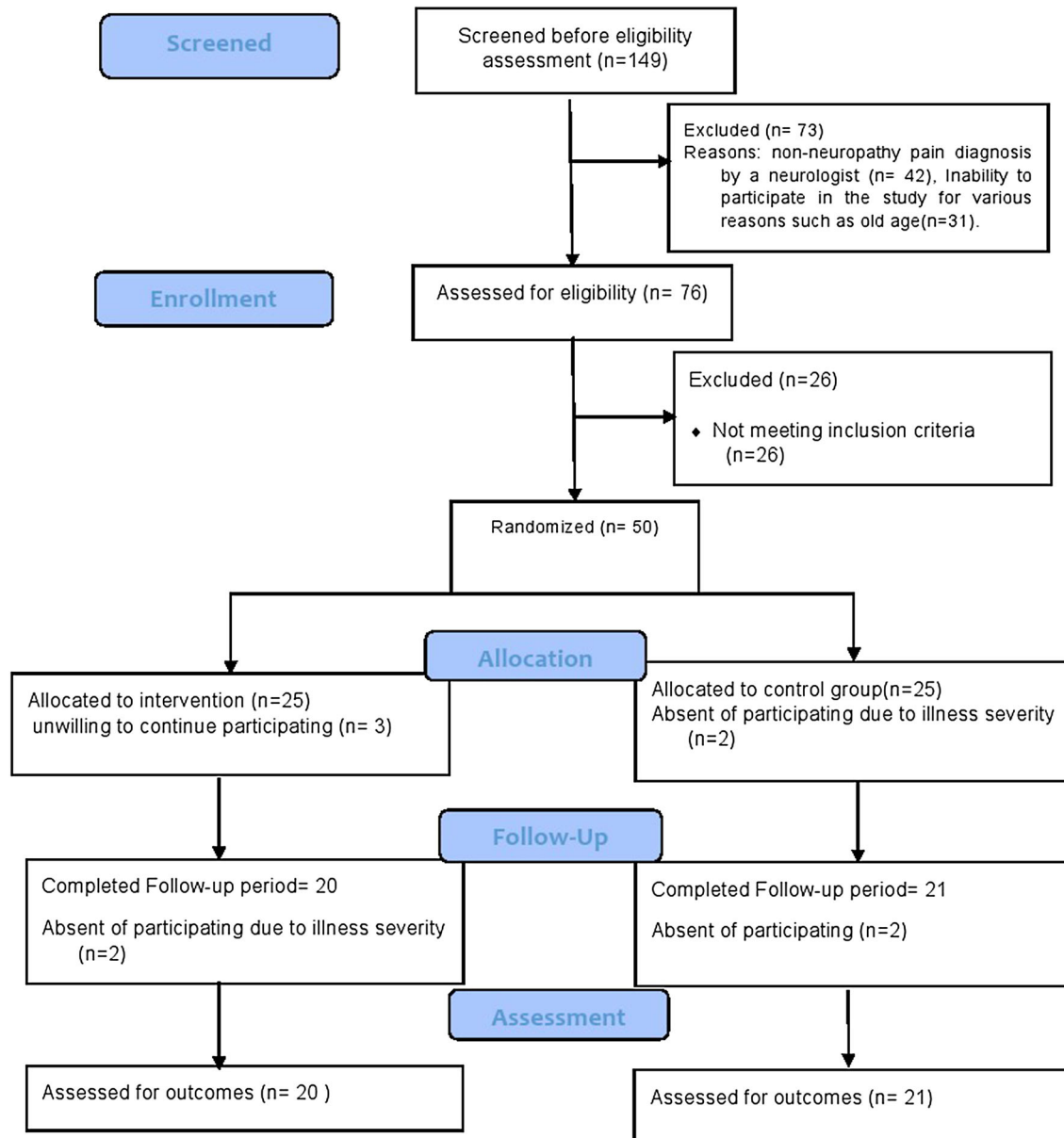
Regarding demographic variables, there were no significant differences between the two groups for age, diabetes history, educational level, and marital status ( $p < 0.05$ ) (Table 2).

In this study, to evaluate the research hypotheses, data distributions were assessed for normality; the results of the Shapiro–Wilk test showed that the data were distributed normally ( $p > 0.05$ ).

### Pain Perception

To compare this variable between the study groups, a repeated-measures ANOVA used. For this purpose, the assumption evaluated the equality of covariance matrices, and then the results of Box's  $M$  test met the equality of covariance matrices (Box's  $M = 16.03$ ,  $p = 0.96$ ). The assumption of homogeneity of variance was met between different levels of measurement ( $p > 0.05$ ).

The assumption of homogeneity of variance was met between different levels of measurement ( $p < 0.05$ ). Mauchly's test of sphericity showed



**Fig. 1** Comparison of mean score of pain perception between ACT group and control group in the pre-test, post-test, and follow-up phases

that the assumption of sphericity ( $p = 0.51$  and Mauchly's  $W = 0.51$ ). The results of the within-group tests showed that the effect of time was significant ( $F = 4.13$ ,  $p = 0.02$ , partial eta squared = 0.09) as was the interaction effect between the time and the groups ( $F = 5.70$ ,  $p = 0.005$ , partial eta squared = 0.13) (Table 3 and Fig. 2).

Because the effects of time and the interaction between time and the groups were

significant, a repeated-measures ANOVA was separately used for each study group. Mauchly's sphericity test showed that the assumption of sphericity was met for both the experimental group ( $p = 0.51$ ) and the control group ( $p = 0.87$ ). The results showed that the effect of time was significant for the experimental group ( $F = 8.81$ ,  $p = 0.001$ ) but it was not significant for the controls ( $F = 0.45$ ,  $p = 0.64$ ).

**Table 2** Comparison of variables between ACT and control groups

Variable	ACT group Frequency (%)	Control group Frequency (%)	<i>p</i> value
Gender			
Male	5 (25)	8 (40)	0.31
Female	15 (75)	12 (60)	
Educational level			
Illiterate	9 (0.45)	8 (0.40)	0.53
Under diploma	7 (0.35)	10 (0.50)	
Having diploma and higher	4 (0.20)	2 (0.10)	
	<b>Mean (SD)</b>	<b>Mean (SD)</b>	
Age	58.6 (9.32)	56.03 (9.7)	0.35
Years of being diabetic	13.2 (4.1)	12.9 (3.8)	0.95
Pain perception			
Pre-test	73 ± 10.27	69.30 ± 8.24	0.31
Post-test	59 ± 9.80	69.85 ± 09.59	0.02
Follow-up	63.95 ± 9.41	72 ± 10.06	0.013
Pain acceptance			
Pre-test	34 ± 12.01	36.25 ± 07.90	0.48
Post-test	51 ± 12.54	33.05 ± 08.46	<i>p</i> < 0.001
Follow-up	47.25 ± 07.58	34.90 ± 10.62	<i>p</i> < 0.001

<sup>a</sup> Data are expressed as *N*%

<sup>b</sup> Independent *t* test was used

<sup>c</sup> The chi-square test was applied

The Bonferroni post hoc test was applied to find out where exactly the difference in levels of measurement lied, and the results demonstrated a 13.2% decrease in the post-test scores of the pain perception as compared to the pre-test scores which were statistically significant ( $p = 0.005$ ). Post-test scores of the pain perception showed a 9.05% reduction compared to the pre-test scores ( $p = 0.01$ ), but follow-up scores demonstrated a 4-point increase compared to the pre-test scores, which were not statistically significant ( $p = 0.6$ ).

Independent sample *t* tests were used to compare pre-test scores of pain perception with follow-up and post-test scores. The results showed that compared to the control group, the mean pain perception scores at post-test ( $p = 0.02$ ) and follow-up were reduced in the interventional group significantly ( $p = 0.01$ ) (Table 2 and Fig. 2).

**Table 3** Repeated measures ANOVA for comparison of pain perception and pain acceptance between ACT group and control group in the pre-test, post-test, and follow-up phases

Variable	Source	Type III sum of squares	df	Mean square	F	Sig	Partial eta squared	Observed power
Pain perception								
Tests of within-subject effects	Time <sup>a</sup>	800.11	2	400.05	4.13	0.020	0.098	0.714
	Time * group	1103.75	2	551.87	5.70	0.005	0.130	0.851
	Error (factor 1)	7355.46	76	96.78				
Tests of between-subject effects	Group	691.20	1	691.20	8.40	0.006	0.181	0.807
	Error	3123.43	38	82.19				
Pain acceptance								
Tests of within-subject effects	Time	1178.45	2	589.22	6.481	0.003	0.146	0.895
	Time * group	2271.81	2	1135.90	12.49	0.000	0.247	0.995
	Error (factor 1)	6909.06	76	90.90				
Tests of between-subject effects	Group	2726.53	1	2726.53	22.48	0.000	0.372	0.996
	Error	4608.13	38	121.26				

<sup>a</sup> Pre-test, post-test, and follow-up

### Pain Acceptance

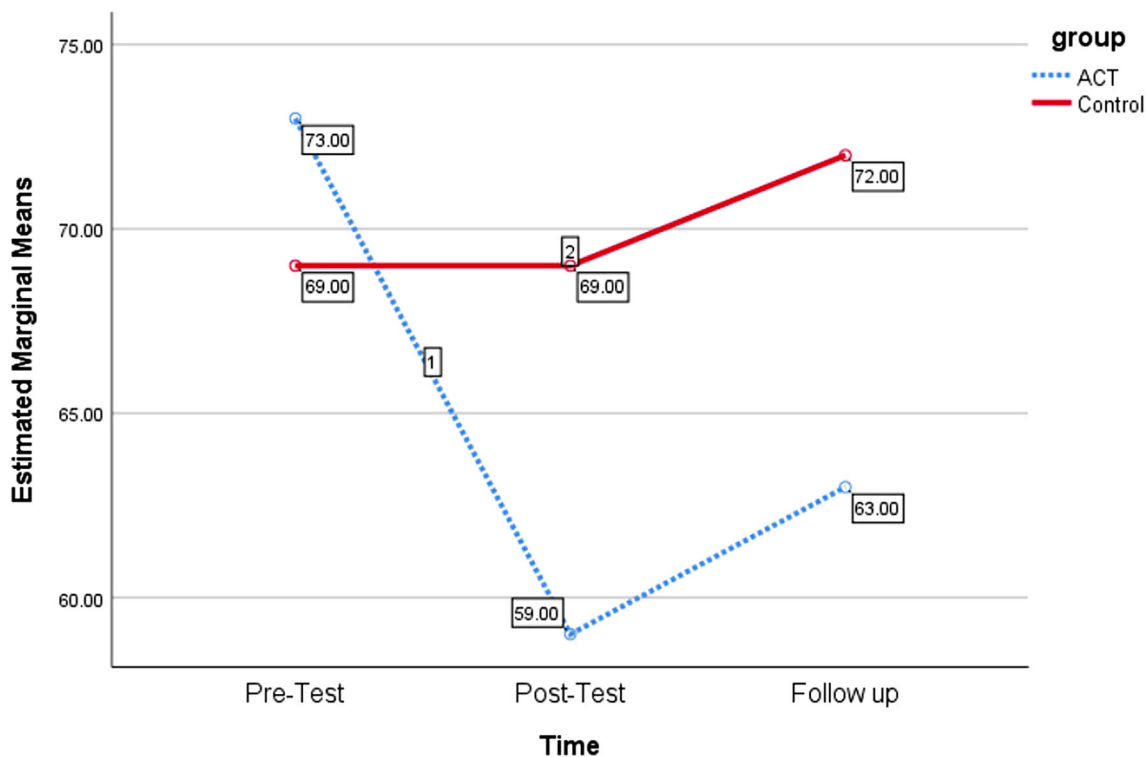
To compare this variable between the study groups, a repeated-measures ANOVA was used. For this purpose, the assumption evaluated the equality of covariance matrices, and then the results of Box's *M* test met the equality of covariance matrices (Box's *M* = 10.95,  $p = 0.12$ ). The assumption of homogeneity of variance was met between different levels of measurement ( $p < 0.05$ ). Mauchly's test confirmed the assumption of sphericity ( $p = 0.51$  and Mauchly's *W* = 0.51). The results of the within-group tests indicated that the effect of time was significant ( $F = 6.48$ ,  $p = 0.003$ , partial eta squared = 0.14) as was the effect of interaction

between the time and groups ( $F = 12.49$ ,  $p < 0.001$ , partial eta squared = 0.24) (Table 3).

As a result of the significant effect of time in both groups, a repeated-measures ANOVA for each group was used. Mauchly's sphericity test indicated that the assumption of sphericity was met for both the groups of cases ( $p = 0.62$ ) and control ( $p = 0.6$ ). The results showed that the effect of time was significant for the case group ( $F = 16.30$ ,  $p < 0.001$ , partial eta squared = 0.46) but it was not significant for the controls ( $F = 0.52$ ,  $p = 0.64$ , partial eta squared = 0.03) (Table 3 and Fig. 3).

According to Bonferroni post hoc test, the post-test scores of the pain acceptance demonstrated a 17.55% increase compared to the pre-test scores, which were statistically significant





**Fig. 2** Comparison of mean score of pain acceptance between ACT group and control group in the pre-test, post-test, and follow-up phases

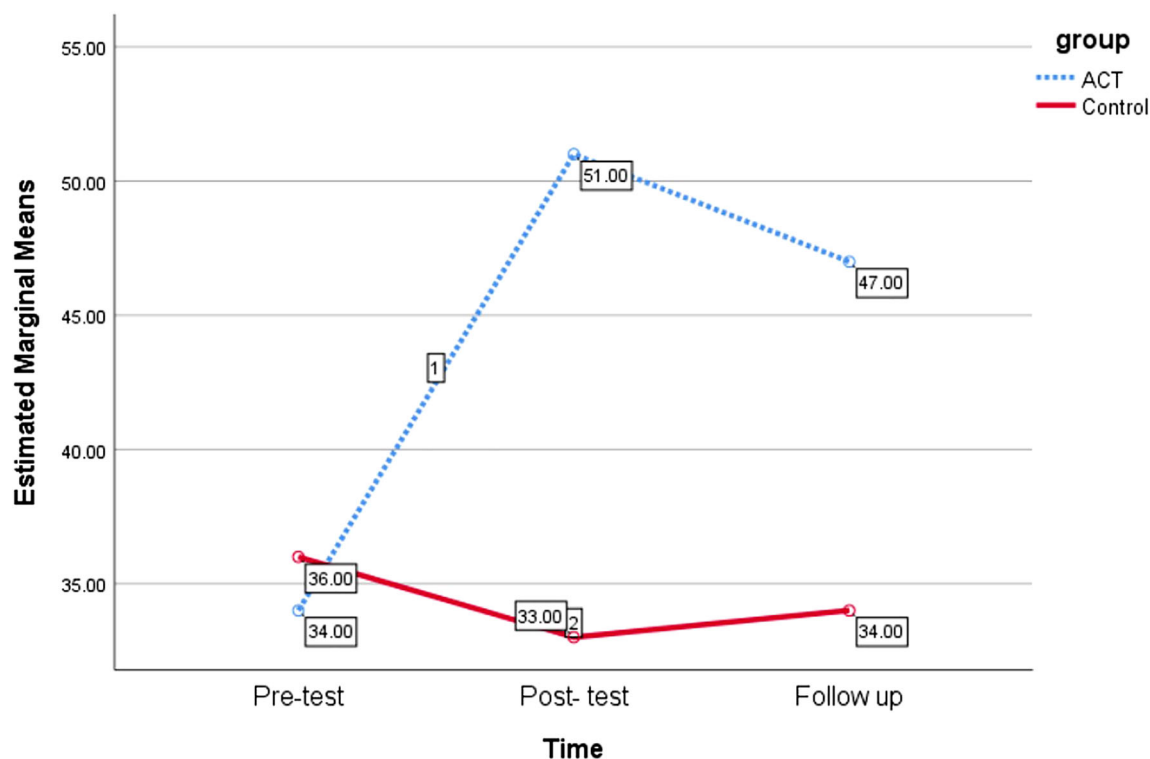
( $p = 0.001$ ). The post-test pain acceptance scores showed a 13.25% increase compared to the pre-test scores ( $p = 0.01$ ), and follow-up scores demonstrated a 4.3% reduction compared to the pre-test scores which were not statistically significant ( $p = 0.51$ ).

Independent sample  $t$  tests were used to compare the pre-test scores of pain acceptance with follow-up and post-test scores. The results showed that compared to the control group the mean pain acceptance scores at post-test ( $p = 0.02$ ) and follow-up were reduced in the interventional group significantly ( $p = 0.01$ ) ( $p < 0.001$ ) (Table 2 and Fig. 2).

## DISCUSSION

Utilizing ACT as the treating approach, the current research aimed at studying the role of pain acceptance in pain perception reduction in patients with painful diabetic neuropathy whose pain was the main symptom. The results

indicated that compared to the control group, the interventional group had significantly improved pain acceptance and a significant reduction in pain perception in the post-test phase. The results were repeated in the 3-month follow-up. This study is one of the first randomized controlled trials in the psychology field dedicated to painful diabetic neuropathy, and its literature review sets out the first steps. The results are consistent with previous studies on the effectiveness of ACT on diseases associated with pain and focus on the acceptance component [38–42]; for example, in an investigation by Herbert et al., the effectiveness of ACT for chronic pain was studied. The results suggested that applying this treatment to patients with chronic pain could significantly lead to reduced pain severity and depression symptoms and increased chronic pain acceptance [43]. In another study, Scott et al. investigated the efficacy of an Internet-based acceptance and commitment therapy. The results indicated that the ACT could



**Fig. 3** Comparison of mean score of pain acceptance between ACT group and control group in the pre-test, post-test, and follow-up phases

significantly reduce pain severity in patients with complex chronic pain [40].

The fundamental element of ACT for treating pain is experiential avoidance. Persons who choose experiential avoidance try to control or avoid pain instead of experiencing it. The primary model for ACT based on Hayes' point of view suggests that trying to control or avoid pain is correlated with higher pain levels [44].

The first step in explaining increased pain acceptance uses the creative hopelessness concept. During the first sessions, the patient learns that trying to control or avoid pain does not reduce the pain and, instead, results in being involved in it [26]. Furthermore, self-as-context and cognitive defusion play a role in pain perception and adapting it. The patients learn that experiencing pain is not the same as their existence and totality [28, 45, 46].

As a result of ACT, the patients learn that there is a difference between one's existential nature and their experiences, affects, feelings, and thoughts, and feeling the pain does not

indicate a total weakness in their personality. Furthermore, the patients learn to be self-observers of experiencing pain, without judgment. Using techniques like the white room, they also learn to experience pain solely in the present moment, similar to other emotions like sadness, happiness, kindness, and anger without trying to reduce it. Various studies have indicated that this leads to increased pain tolerance and decreased pain perception [47, 48].

Finally, the patients learn to identify and clarify their values and act on them. In a study on ACT, Wetherell indicated that patients with chronic pain who mostly live according to their values are less likely to catastrophize pain and more likely to accept it [24].

This research indicated that emphasizing acceptance and living according to personal values despite the pain and using self-as-context and cognitive defusion techniques could significantly lower the pain perception and increase social and work functioning in the patients.

Future studies measuring concepts related to acceptance and pain tolerance are recommended in patients with PDN. These concepts include self-kindness and common humanity based on a mindful self-compassion approach. Moreover, in the current protocol, acceptance is the main emphasized component for the first three sessions; it is recommended that future investigations use mid-test to focus on acceptance solely without involving the other therapeutic components and measuring if it can predict the reduction of pain severity in the ACT model for pain in neuropathy. Moreover, according to van Laake-Geelen's research in 2019, utilizing physical, behavioral techniques such as exercise therapy accompanied by ACT results in improved diabetic neuropathy pain management [49].

The limitations of the current research include using no measure of actual daily functioning, disability, and emotional functioning, utilizing self-report scales, reduction in sample size due to high dropout rate during screening regarding inclusion and exclusion criteria for neuropathy pain, low educability of the clinical sample due to the age range and being aged and not having an extended follow-up for examining the stability of pain acceptance on decreasing pain perception.

## CONCLUSIONS

The results indicated that acceptance and commitment therapy could be used as a psychological intervention alongside pharmacotherapy to improve pain acceptance and reduce pain perception in patients with painful diabetic neuropathy.

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**Compliance with Ethics Guidelines.** All participants signed a consent form before the initiation of the research. The tools were filled in anonymously, and an ID code was used to maintain the confidentiality of personal information. The research ethics committee of Kermanshah University of Medical Sciences approved the study (IR.KUMS.REC.1397.939). This study was registered at the Iranian Registry of Clinical Trials (IRCT20180205038630N4). The study was conducted in accordance with the Helsinki Declaration of 1964 and its later amendments.

**Data Availability.** The datasets analyzed during the current study are available from the corresponding author on reasonable request.

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## REFERENCES

1. Probst T, Jank R, Dreyer N, et al. Early changes in pain acceptance predict pain outcomes in interdisciplinary treatment for chronic pain. *J Clin Med*. 2019;8(9):1373.
2. Gatchel RJ, McGeary DD, McGeary CA, Lippe BJAP. Interdisciplinary chronic pain management: past, present, and future. *Am Psychol*. 2014;69(2):119.
3. Pieh C, Neumeier S, Loew T, et al. effectiveness of a multimodal treatment program for somatoform pain disorder. *Pain Pract*. 2014;14(3):E146–E151.
4. Kumar KH, Elavarasi P. Definition of pain and classification of pain disorders. *J Adv Clin Res Insight*. 2016;3(3):87–90.
5. Baron R, Maier C, Attal N, et al. Peripheral neuropathic pain: a mechanism-related organizing principle based on sensory profiles. *Pain*. 2017;158(2):261.
6. Callaghan BC, Cheng HT, Stables CL, Smith AL, Feldman EL. Diabetic neuropathy: clinical manifestations and current treatments. *Lancet Neurol*. 2012;11(6):521–34.
7. Pop-Busui R, Boulton AJ, Feldman EL, et al. Diabetic neuropathy: a position statement by the American Diabetes Association. *Diabetes Care*. 2017;40(1):136–54.
8. Abbott CA, Malik RA, van Ross ER, Kulkarni J, Boulton AJM. Prevalence and characteristics of painful diabetic neuropathy in a large community-based diabetic population in the UK. *Diabetes Care*. 2011;34(10):2220–4.
9. Yamany AA, Sayed HM. Effect of low-level laser therapy on the neurovascular function of diabetic peripheral neuropathy. *J Adv Res*. 2012;3(1):21–8.
10. Selph S, Carson S, Fu R, Thakurta S, Low A, McDonagh M. Drug class review: neuropathic pain: final update one report. Oregon Health & Science University. 2011. <https://www.altmetric.com/details/64369704>.
11. Tong Y, Guo H, Han B. Fifteen-day acupuncture treatment relieves diabetic peripheral neuropathy. *J Acupuncture Meridian Stud*. 2010;3(2):95–103.
12. Iqbal Z, Azmi S, Yadav R, et al. Diabetic peripheral neuropathy: epidemiology, diagnosis, and pharmacotherapy. *Clin Ther*. 2018;40(6):828–49.
13. Waldfoegel JM, Nesbit SA, Dy SM, et al. Pharmacotherapy for diabetic peripheral neuropathy pain and quality of life: a systematic review. *Neurology*. 2017;88(20):1958–67.
14. Ziegler D, Fonseca V. From guideline to the patient: a review of recent recommendations for pharmacotherapy of painful diabetic neuropathy. *J Diabetes Complicat*. 2015;29(1):146–56.
15. Melzack R. Pain and the neuromatrix in the brain. *J Dent Educ*. 2001;65(12):1378–82.
16. Melzack R, Wall PD. Pain mechanisms: a new theory. *Science*. 1965;150(3699):971–9.
17. Kioskli K, Scott W, Winkley K, Kylakos S, McCracken LM. Psychosocial factors in painful diabetic neuropathy: a systematic review of treatment trials and survey studies. *Pain Med*. 2019;20(9):1756–73.
18. Eccleston C, Hearn L, de C Williams AC. Psychological therapies for the management of chronic neuropathic pain in adults. *Cochrane Database Syst Rev*. 2015(10):CD011259.
19. McCracken LM, Vowles KE. Acceptance and commitment therapy and mindfulness for chronic pain: model, process, and progress. *Am Psychol*. 2014;69(2):178.
20. Vowles KE, McCracken LM, Eccleston C. Processes of change in treatment for chronic pain: the contributions of pain, acceptance, and catastrophizing. *Eur J Pain*. 2007;11(7):779–87.
21. McCracken LM, Carson JW, Eccleston C, Keefe FJ. Acceptance and change in the context of chronic pain. *Pain*. 2004;109(1):4–7.

22. McCracken LM, Turk DC. Behavioral and cognitive-behavioral treatment for chronic pain: outcome, predictors of outcome, and treatment process. *Spine*. 2002;27(22):2564–73.
23. Smeets RJ, Beelen S, Goossens ME, Schouten EG, Knottnerus JA, Vlaeyen JW. Treatment expectancy and credibility are associated with physical and cognitive-behavioral treatment in chronic low back pain. *Clin J Pain*. 2008;24(4):305–15.
24. Wetherell JL, Afari N, Rutledge T, et al. A randomized, controlled trial of acceptance and commitment therapy and cognitive-behavioral therapy for chronic pain. *Pain*. 2011;152(9):2098–107.
25. Veehof MM, Oskam M-J, Schreurs KM, Bohlmeijer ET. Acceptance-based interventions for the treatment of chronic pain: a systematic review and meta-analysis. *Pain*. 2011;152(3):533–42.
26. Hayes SC, Strosahl KD, Wilson KG. *Acceptance and commitment therapy: the process and practise of mindful change*. New York: Guilford; 2011.
27. Xu X, Cheng Q, Ou M, Li S, Xie C, Chen Y. Pain acceptance in cancer patients with chronic pain in Hunan, China: a qualitative study. *Int J Nurs Sci*. 2019;6(4):385–91.
28. Hann KE, McCracken LM. A systematic review of randomized controlled trials of acceptance and commitment therapy for adults with chronic pain: outcome domains, design quality, and efficacy. *J Context Behav Sci*. 2014;3(4):217–27.
29. Hayes SC, Luoma JB, Bond FW, Masuda A, Lillis J. Acceptance and commitment therapy: model, processes, and outcomes. *Behav Res Ther*. 2006;44(1):1–25.
30. Fonseca V. Importance of weight management in type 2 diabetes: a review with meta-analysis of clinical studies. *Diabetes Care*. 2004;27(3):855.
31. Cramer JA. A systematic review of adherence with medications for diabetes. *Diabetes Care*. 2004;27(5):1218–24.
32. Melzack R, Katz J. The McGill Pain Questionnaire: appraisal and current status. In: Turk DC, Melzack R, editors. *Handbook of pain assessment*. The Guilford Press; 2001. p. 35–52.
33. Burckhardt CS, Jones KD. Adult measures of pain: the McGill pain questionnaire (MPQ), rheumatoid arthritis pain scale (RAPS), short-form McGill pain questionnaire (SF-MPQ), verbal descriptive scale (VDS), visual analog scale (VAS), and West Haven-Yale multidisciplinary pain inventory (WHYMPI). *Arthritis Care Res*. 2003;49(S5):S96–S104.
34. Khosravi M, Sadighi S, Moradi S, Zendehdel K. Persian-McGill pain questionnaire; translation, adaptation, and reliability in cancer patients: a brief report. *Tehran Univ Med J*. 2013;71(1):53–8.
35. Mesgarian F, Asghari A, Shaeiri MR, Broumand A. The Persian version of the chronic pain acceptance questionnaire. *Clin Psychol Psychother*. 2013;20(4):350–8.
36. Vowles KE, McCracken LM, McLeod C, Eccleston C. The Chronic Pain Acceptance Questionnaire: confirmatory factor analysis and identification of patient subgroups. *Pain*. 2008;140(2):284–91.
37. Hughes LS, Clark J, Colclough JA, Dale E, McMillan D. Acceptance and commitment therapy (ACT) for chronic pain. *Clin J Pain*. 2017;33(6):552–68.
38. Hadlandsmyth K, White KS, Nesin AE, Greco LA. Proposing an acceptance and commitment therapy intervention to promote improved diabetes management in adolescents: a treatment conceptualization. *Int J Behav Consult Ther*. 2013;7(4):12.
39. Sheppard SC, Forsyth JP, Hickling EJ, Bianchi J. A novel application of acceptance and commitment therapy for psychosocial problems associated with multiple sclerosis: results from a half-day workshop intervention. *Int J MS Care*. 2010;12(4):200–6.
40. Scott W, Chilcot J, Guildford B, Daly-Eichenhardt A, McCracken L. Feasibility randomized-controlled trial of online acceptance and commitment therapy for patients with complex chronic pain in the United Kingdom. *Eur J Pain*. 2018;22(8):1473–84.
41. Wicksell R, Kemani M, Jensen K, et al. Acceptance and commitment therapy for fibromyalgia: a randomized controlled trial. *Eur J Pain*. 2013;17(4):599–611.
42. Foote HW, Hamer JD, Roland MM, Landy SR, Smitherman TA. Psychological flexibility in migraine: a study of pain acceptance and values-based action. *Cephalalgia*. 2016;36(4):317–24.
43. Herbert MS, Malaktaris AL, Dochat C, Thomas ML, Wetherell JL, Afari N. Acceptance, and commitment therapy for chronic pain: does post-traumatic stress disorder influence treatment outcomes? *Pain Med*. 2019;20(9):1728–36.
44. Hayes SC. Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies—republished article. *Behav Ther*. 2016;47(6):869–85.
45. Hayes SC, Strosahl KD, Wilson KG. *Acceptance and commitment therapy*. Washington: American Psychological Association; 2009.

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46. Yu L, Norton S, McCracken LM. Change in “self-as-context” (“perspective-taking”) occurs in acceptance and commitment therapy for people with chronic pain and is associated with improved functioning. *J Pain*. 2017;18(6):664–72.
  47. Åkerblom S, Perrin S, Fischer MR, McCracken LM. The mediating role of acceptance in multidisciplinary cognitive-behavioral therapy for chronic pain. *J Pain*. 2015;16(7):606–15.
  48. Feinstein AB, Forman EM, Masuda A, et al. Pain intensity, psychological inflexibility, and acceptance of pain as predictors of functioning in adolescents with juvenile idiopathic arthritis: a preliminary investigation. *J Clin Psychol Med Settings*. 2011;18(3):291–8.
  49. van Laake-Geelen CC, Smeets RJ, Quadflieg SP, Kleijnen J, Verbunt JA. Exercise therapy combined with psychological therapy on physical activity and quality of life in patients with painful diabetic neuropathy: a systematic review. *Scand J Pain*. 2019;19(3):433–9.