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# The Effectiveness of Emotion Regulation Training on Pain Perception, Resilience, Quality of Life, and Treatment Adherence in Patients with Chronic Pain

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## ABSTRACT

This study aimed to investigate the effectiveness of emotion regulation training in reducing pain perception and improving resilience, quality of life, and treatment adherence among patients with chronic pain. This applied, quasi-experimental study employed a pretest–posttest–follow-up design with a control group. The statistical population consisted of female patients with chronic pain who presented to chronic pain clinics and medical centers in Tehran in 2024. Thirty eligible patients were recruited through convenience sampling from among volunteers and were randomly assigned to either the emotion regulation training group (n = 15) or the control group (n = 15). The experimental group participated in an emotion regulation training program, whereas the control group received no psychological intervention. Data were collected using the McGill Pain Questionnaire, the Connor–Davidson Resilience Scale, the World Health Organization Quality of Life Questionnaire, and the Treatment Adherence Questionnaire. The data were analyzed using multivariate analysis of covariance, repeated-measures analysis of variance, and Bonferroni-adjusted post hoc comparisons. The findings indicated that emotion regulation training significantly reduced pain perception and improved resilience, quality of life, and treatment adherence compared with the control condition. The multivariate effect of group was statistically significant, Wilks' $\Lambda = .06$, $F = 37.83$, $p < .001$, $\eta^2 = .74$. The group effect was also statistically significant for pain perception, $F = 41.35$, $p < .001$, $\eta^2 = .68$; resilience, $F = 132.47$, $p < .001$, $\eta^2 = .86$; quality of life, $F = 72.38$, $p < .001$, $\eta^2 = .79$; and treatment adherence, $F = 96.24$, $p < .001$, $\eta^2 = .83$. Emotion regulation training was effective in reducing pain perception and enhancing resilience, quality of life, and treatment adherence among patients with chronic pain. Therefore, this intervention may be employed as an adjunctive psychological approach to chronic pain management.

**Keywords:** emotion regulation training; pain perception; resilience; quality of life; treatment adherence; chronic pain

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## Introduction

Chronic pain is a complex and persistent health condition that extends beyond the immediate experience of physical discomfort and affects emotional functioning, cognitive processing, interpersonal relationships, occupational performance, and engagement with health care. Unlike acute pain, which generally serves a protective biological function and resolves as tissue healing occurs, chronic pain persists over time and may remain present even when the original physical cause has been treated or is no longer clearly identifiable. Consequently, patients may experience recurrent or continuous pain accompanied by fatigue, sleep

disturbances, reduced mobility, functional limitations, emotional distress, and diminished participation in meaningful activities. The prolonged nature of chronic pain also creates uncertainty regarding symptom progression, treatment effectiveness, and the possibility of recovery. This uncertainty can intensify fear, helplessness, and vigilance toward bodily sensations, thereby increasing the subjective burden of pain. Evidence from individuals with chronic low back pain suggests that uncertainty tolerance, hope, and emotion regulation are closely interconnected and contribute to how patients understand and manage persistent pain experiences (1). Accordingly, contemporary approaches increasingly conceptualize chronic pain as a biopsychosocial phenomenon in which physiological processes interact dynamically with cognitive appraisals, emotional responses, behavioral patterns, and social conditions.

Pain perception is not determined solely by the intensity of nociceptive stimulation. Rather, it is shaped by attention, expectation, memory, interpretation, emotional arousal, and previous experiences of pain. Patients who interpret pain as uncontrollable, threatening, or indicative of serious damage may become increasingly attentive to symptoms and may engage in catastrophic thinking. Pain catastrophizing commonly involves magnification of the perceived threat, repetitive focus on painful sensations, and feelings of helplessness regarding the ability to cope. These cognitive and emotional reactions can heighten physiological arousal, increase muscular tension, reduce activity, and reinforce avoidance behaviors, all of which may amplify the experience of pain. Research among patients with chronic pain has demonstrated that pain severity and catastrophizing are associated with both resilience and emotion regulation, indicating that individuals with limited emotion regulation capacities and lower resilience may experience greater subjective pain and more maladaptive interpretations of their symptoms (2). Similarly, research on pain management in women with breast cancer has shown that rumination plays an important mediating role in the relationship between resilience, vitality, and pain management, highlighting the importance of repetitive emotional and cognitive processes in determining how pain is experienced and managed (3). Therefore, interventions that modify emotional reactions and pain-related cognitive processing may reduce the amplification of pain even when the underlying medical condition remains unchanged.

Emotion regulation refers to the processes through which individuals monitor, evaluate, and modify emotional reactions in accordance with situational demands and personal goals. These processes may influence which emotions arise, when they occur, how intensely they are experienced, and how they are expressed behaviorally. Adaptive emotion regulation includes emotional awareness, accurate identification of feelings, acceptance of emotional experiences, cognitive reappraisal, flexible attentional deployment, problem solving, and constructive emotional expression. In contrast, maladaptive strategies include suppression, avoidance, rumination, self-blame, catastrophizing, emotional inhibition, and persistent preoccupation with distressing experiences. In chronic pain, maladaptive emotion regulation may intensify suffering by increasing attention to pain, prolonging negative affect, weakening perceived control, and interfering with adaptive coping. Patients may suppress anger or fear, repeatedly think about the consequences of pain, avoid activities associated with discomfort, or interpret emotional distress as evidence that their condition is worsening. Such responses can maintain a cycle in which pain produces negative emotion, negative emotion heightens pain perception, and intensified pain generates further emotional distress. The development of targeted emotion regulation interventions for patients with pain and emotional distress therefore represents an important direction in psychological pain management (4).

The relationship between emotion regulation and chronic pain is especially important because persistent pain frequently co-occurs with anxiety, depressive symptoms, irritability, hopelessness, and reduced motivation. These emotional difficulties may not merely result from pain but may also contribute to its maintenance and functional consequences. Emotion-focused interventions can help patients recognize the meaning of their emotional responses, tolerate distress without excessive avoidance, and replace inflexible emotional patterns with more adaptive strategies. Recent evidence indicates that emotion-focused therapy can reduce emotion dysregulation and increase resilience in patients experiencing chronic pain and depressive symptoms (5). Findings from dialysis patients have also shown that psychologically oriented treatments such as acceptance and commitment therapy and dialectical behavior therapy can influence pain intensity and behavioral emotion regulation, suggesting that improvements in emotional functioning may be accompanied by changes in the experience and management of physical symptoms (6). Beyond clinical treatment contexts, experimental research has demonstrated that selective emotion regulation during creative activity can reduce anxiety and alter psychophysiological reactivity, further supporting the proposition that intentional modulation of emotion can produce measurable psychological and physiological effects (7). Collectively, these findings indicate that emotion regulation is a modifiable psychological process with potential relevance to both emotional distress and pain-related outcomes.

One of the major adaptive resources affected by chronic pain is resilience. Resilience refers to the capacity to maintain or regain psychological functioning in the face of adversity, stress, illness, and prolonged life challenges. In patients with chronic pain, resilience does not necessarily imply the absence of pain or distress. Instead, it reflects the ability to adapt to ongoing symptoms, preserve a sense of competence, use available coping resources, maintain meaningful goals, and recover from periods of increased pain or disability. Resilient patients may interpret pain episodes as manageable, remain engaged in treatment, continue valued activities within realistic limits, and respond flexibly to setbacks. Conversely, low resilience may contribute to helplessness, withdrawal, inactivity, treatment disengagement, and increased sensitivity to stress. Studies examining emotional regulation, resilience, and self-efficacy have found meaningful relationships among these constructs, indicating that individuals who regulate emotions more effectively may be better able to mobilize adaptive psychological resources when facing difficult experiences (8). Research involving older patients after total knee arthroplasty has similarly shown that cognitive emotion regulation and pain-management self-efficacy contribute to the relationship between pain resilience and pain catastrophizing (9). These findings suggest that resilience may be strengthened through interventions that improve emotional awareness, cognitive flexibility, and perceived capacity to manage pain.

Emotion regulation training may enhance resilience through several complementary mechanisms. First, learning to identify and label emotional states can reduce confusion and increase perceived control over internal experiences. Second, acceptance-based skills can help patients tolerate distressing emotions without immediately resorting to suppression or avoidance. Third, cognitive reappraisal can reduce catastrophic interpretations of pain and support more balanced evaluations of physical symptoms and functional limitations. Fourth, relaxation and attentional regulation may decrease emotional and physiological arousal. Finally, problem-solving and adaptive emotional expression can strengthen interpersonal support and improve communication with health professionals and family members. When these skills are integrated, patients may become more capable of responding flexibly to fluctuations in pain, treatment difficulties, and

everyday stressors. This pattern is consistent with evidence that psychological flexibility and emotion regulation can function as important pathways linking maladaptive behavioral tendencies to psychological well-being over time (10). Although that evidence was obtained in adolescents in relation to smartphone addiction, the underlying mechanism is relevant to chronic illness because psychological flexibility and adaptive regulation may protect well-being across diverse forms of persistent stress.

Quality of life is another major outcome affected by chronic pain. It encompasses physical health, psychological well-being, social relationships, environmental resources, and the individual's overall evaluation of life circumstances. Chronic pain can compromise quality of life by restricting mobility, disturbing sleep, reducing energy, interfering with employment and family responsibilities, and limiting social and recreational participation. The emotional consequences of persistent pain may further impair quality of life by increasing anxiety, depressive symptoms, irritability, isolation, and loss of meaning. Because quality of life reflects both objective functioning and subjective evaluation, patients with similar medical conditions may report substantially different levels of well-being depending on their coping patterns, emotional responses, social support, and perceived control. Cognitive emotion regulation strategies have been shown to predict resilience, symptom severity, and quality of life among patients with irritable bowel syndrome, demonstrating that the ways individuals interpret and emotionally manage chronic symptoms are closely related to broader well-being (11). Research among veterans has likewise indicated that emotion regulation, mindfulness, and self-compassion predict multiple dimensions of quality of life, reinforcing the importance of emotional processes for physical, psychological, and social functioning (12).

Emotion regulation training may improve quality of life even when it does not completely eliminate pain. By reducing emotional reactivity, catastrophizing, and avoidance, patients may become more willing to participate in daily activities, communicate their needs, seek social support, and pursue meaningful goals despite continuing symptoms. Improved emotional regulation may also facilitate sleep, concentration, interpersonal functioning, and adherence to rehabilitation recommendations. In addition, training patients to distinguish pain sensations from catastrophic thoughts and emotional reactions may reduce the extent to which pain dominates their self-concept and everyday decisions. Long-term medical treatment itself can produce emotional and cognitive burdens, particularly when patients experience fatigue, adverse effects, uncertainty, or a sense of diminished autonomy. Qualitative evidence regarding long-term antipsychotic medication use has shown that prolonged treatment can influence emotional experience, cognitive functioning, and patients' perceptions of themselves and their care (13). Although the clinical population differs from patients with chronic pain, such findings underscore the broader importance of considering emotional and cognitive experiences when evaluating quality of life in individuals receiving long-term treatment.

Treatment adherence is also central to the effective management of chronic pain. Chronic pain treatment commonly requires sustained engagement with medication regimens, physiotherapy, exercise, behavioral recommendations, follow-up appointments, lifestyle modifications, and psychological interventions. However, adherence may be difficult because improvements are often gradual, symptoms may fluctuate, treatment recommendations may be demanding, and patients may become discouraged by incomplete relief. Emotional distress, hopelessness, anger, fear of pain, treatment fatigue, and negative beliefs about health

care can further undermine commitment to treatment. Patients who experience difficulty regulating emotion may discontinue exercises when pain increases, avoid appointments because of anxiety, use medication inconsistently, or withdraw from treatment after setbacks. Research involving individuals with type 2 diabetes has shown that repetitive negative thoughts, emotion regulation, and self-care strategies predict acceptance of and adherence to treatment, demonstrating that adherence is influenced not only by medical instructions but also by cognitive and emotional processes (14). Similarly, differences in emotion regulation difficulties, self-compassion, and treatment adherence have been examined among individuals with substance-use problems and differing health conditions, indicating that adherence is meaningfully connected to psychological adjustment and emotional functioning (15).

Emotion regulation training may strengthen treatment adherence by helping patients manage frustration, tolerate uncertainty, and respond adaptively to temporary symptom exacerbation or slow therapeutic progress. Patients who can reappraise setbacks as manageable rather than as evidence of treatment failure may be more likely to continue prescribed activities and maintain engagement with health professionals. Emotional awareness can also help patients recognize when anger, fear, sadness, or hopelessness is influencing treatment decisions. Moreover, problem-solving and effective emotional expression may improve communication with clinicians, enable patients to discuss concerns about medication or rehabilitation, and support collaborative decision-making. These mechanisms are particularly important in chronic pain because successful management often depends on sustained self-regulation rather than passive receipt of treatment. Thus, treatment adherence may be understood as a behavioral outcome partly rooted in emotional flexibility, perceived competence, and the ability to persist despite discomfort.

Despite growing evidence regarding the role of emotional processes in chronic illness, previous studies have often examined pain intensity, emotional dysregulation, resilience, quality of life, or treatment adherence separately. Some studies have focused on predicting pain severity and catastrophizing from resilience and emotion regulation (2), whereas others have examined emotion-focused treatment in relation to dysregulation and resilience (5), cognitive emotion regulation in relation to quality of life (11), or emotional and cognitive predictors of treatment adherence (14). This fragmented approach limits understanding of whether a single structured intervention can simultaneously affect the subjective experience of pain, adaptive psychological capacity, broader quality of life, and sustained engagement with treatment. Because these outcomes are theoretically interconnected, evaluating them within a unified intervention framework may provide a more comprehensive account of the clinical value of emotion regulation training.

The need for such an integrated examination is particularly important among women with chronic pain. Women may encounter biological, psychological, interpersonal, and sociocultural factors that influence pain reporting, emotional expression, caregiving responsibilities, access to support, and treatment participation. Persistent pain can interfere with family roles, occupational functioning, social relationships, and personal autonomy, while emotional distress may be minimized or interpreted solely as a consequence of the medical condition. A structured group-based emotion regulation program may provide participants with both psychological skills and an interpersonal context in which pain-related experiences can be recognized and normalized. Through emotional awareness, acceptance, cognitive reappraisal, physiological regulation, constructive expression, and problem solving, such training may interrupt the reciprocal cycle between

negative affect and pain, increase resilience, improve perceived quality of life, and support more consistent adherence to treatment.

Accordingly, the present study aimed to determine the effectiveness of emotion regulation training in reducing pain perception and improving resilience, quality of life, and treatment adherence among female patients with chronic pain.

## Methods and Materials

### *Study Design and Participants*

This applied study employed a quasi-experimental pretest–posttest–follow-up design with a control group to investigate the effectiveness of emotion regulation training in reducing pain perception and improving resilience, quality of life, and treatment adherence among patients with chronic pain. Emotion regulation training constituted the independent variable, whereas pain perception, resilience, quality of life, and treatment adherence were the dependent variables. All outcome variables were assessed at three measurement occasions: before the intervention, immediately after the intervention, and at follow-up. Although the original research design included two active intervention groups and one control group, the present article reports only the findings for the emotion regulation training group and the control group. Accordingly, all methodological descriptions and statistical analyses presented in this article are restricted to these two groups.

The statistical population consisted of all female patients with chronic pain who attended chronic pain clinics and medical centers in Tehran, Iran, in 2024. Participants were recruited using convenience sampling from among patients who voluntarily expressed an interest in participating in the study. Following an initial eligibility assessment, 30 women with chronic pain were enrolled and randomly allocated to either the emotion regulation training group ($n$ = 15) or the control group ($n$ = 15). Participants assigned to the experimental group received the emotion regulation training intervention, whereas those assigned to the control group received no psychological intervention during the study period and were placed on a waiting list. Participants in both groups continued to receive their routine medical care throughout the study.

The inclusion criteria were a formal diagnosis of chronic pain by a pain specialist, persistence of pain for at least 6 months, an age range of 18 to 65 years, sufficient physical and psychological capacity to attend the training sessions and complete the assigned exercises, fluency in Persian, adequate literacy for completing the questionnaires, and provision of written informed consent. The exclusion criteria were the development of a medical condition that prevented attendance or completion of the intervention exercises, a substantial deterioration in medical status requiring urgent specialized treatment, absence from more than 25% of the intervention sessions, voluntary withdrawal because of personal or environmental circumstances, the presence of another physical or psychological disorder requiring greater diagnostic or therapeutic priority, and concurrent participation in another psychological intervention during the study period. Routine pharmacological treatment and physiotherapy were not considered exclusionary, provided that they remained stable and were part of the participants' usual medical care.

After the necessary administrative and ethical permissions had been obtained, potentially eligible patients were identified at the participating chronic pain clinics and medical centers. The aims, procedures, voluntary nature, potential benefits, and possible inconveniences of participation were explained to all candidates.

Patients who met the eligibility criteria and agreed to participate provided written informed consent. Before group allocation and the commencement of the intervention, all participants completed the demographic information form and the study questionnaires as the pretest assessment. Participants were subsequently assigned to the experimental and control groups. The experimental group attended the emotion regulation training sessions, whereas the control group received no psychological intervention during the corresponding period. Immediately after completion of the intervention, both groups completed the same questionnaires as the posttest assessment. The instruments were administered again at follow-up to evaluate the maintenance of the intervention effects over time.

### *Data Collection*

A demographic information form developed for the present study was used to collect participants' background and clinical characteristics. The form included items assessing age, marital status, educational attainment, employment status, duration of chronic pain, medical history, and other relevant treatment-related information. The collected demographic data were used to characterize the sample, examine the comparability of the study groups, and provide contextual information for interpreting the findings.

Pain perception was measured using the McGill Pain Questionnaire developed by Melzack (1975). The instrument was designed to assess the multidimensional and subjective nature of pain and contains 20 groups of verbal descriptors from which respondents select the words that most accurately characterize their pain experience. The questionnaire evaluates sensory, affective, evaluative, and miscellaneous dimensions of pain. Its scoring procedure is based on the rank values assigned to the selected descriptors, with higher scores reflecting greater pain intensity and a more severe subjective pain experience. The McGill Pain Questionnaire has been widely used in clinical and research settings involving acute and chronic pain, and its original psychometric evaluation demonstrated satisfactory reliability and validity (Melzack, 1975). Persian-language studies have also reported acceptable psychometric properties, including satisfactory internal consistency and test–retest reliability. In the present study, the total questionnaire score was used as the principal indicator of pain perception.

Resilience was assessed using the Connor–Davidson Resilience Scale developed by Connor and Davidson (2003). This self-report measure consists of 25 items designed to assess an individual's capacity to cope with adversity, recover from stressful experiences, and maintain adaptive functioning under difficult circumstances. Each item is rated on a 5-point Likert-type scale ranging from 0, indicating that the statement is not true at all, to 4, indicating that it is true nearly all the time. Total scores range from 0 to 100, with higher scores indicating greater psychological resilience. The scale encompasses characteristics related to personal competence, persistence, tolerance of negative affect, positive acceptance of change, perceived control, secure relationships, and spiritual influences. Connor and Davidson (2003) reported high internal consistency, satisfactory test–retest reliability, and evidence of convergent and discriminant validity. Studies conducted with Iranian populations have similarly supported the reliability and construct validity of the Persian version of the scale.

Quality of life was evaluated using the 26-item World Health Organization Quality of Life–Brief Version. This instrument assesses perceived quality of life across four major domains: physical health, psychological health, social relationships, and environmental conditions. Items are rated on a 5-point Likert-type scale,

with higher domain and total scores representing a more favorable perceived quality of life. The physical health domain covers pain and discomfort, energy and fatigue, sleep and rest, mobility, activities of daily living, dependence on medication or medical treatment, and work capacity. The psychological domain assesses positive and negative feelings, cognitive functioning, self-esteem, body image, personal beliefs, and spirituality. The social relationships domain evaluates personal relationships, perceived social support, and sexual activity, whereas the environmental domain addresses physical safety, financial resources, access to health care, the home environment, opportunities to obtain information, recreational activities, the physical environment, and transportation. The instrument has demonstrated acceptable reliability and validity across diverse cultural and clinical populations, and studies of its Persian version have supported its internal consistency, factorial structure, and criterion-related validity.

Treatment adherence was measured using the Treatment Adherence Questionnaire developed by Modanloo (2013) for patients with chronic illnesses. The questionnaire consists of 40 items and evaluates several behavioral, cognitive, and motivational dimensions of adherence, including attention to treatment, willingness to participate in treatment, adaptability, integration of treatment recommendations into daily life, persistence in following the treatment plan, commitment to treatment, and hesitation in implementing therapeutic recommendations. Raw scores are converted to a standardized score ranging from 0 to 100, with higher scores indicating better adherence. Scores between 75 and 100 represent very good treatment adherence, scores between 50 and 74 indicate good adherence, scores between 25 and 49 reflect moderate adherence, and scores between 0 and 24 indicate poor adherence. Previous psychometric evaluations have supported the instrument's content validity, internal consistency, and suitability for assessing adherence-related behaviors in individuals with chronic health conditions.

### *Intervention*

The experimental group participated in an eight-session group-based emotion regulation training program specifically adapted to the psychological and functional needs of patients with chronic pain. The intervention was designed to improve participants' ability to identify, understand, accept, express, and regulate emotions associated with persistent pain. The first session focused on orientation, establishment of therapeutic rapport, clarification of group rules, presentation of the intervention objectives, and explanation of chronic pain as a biopsychosocial phenomenon influenced by physiological, cognitive, emotional, behavioral, and interpersonal processes. The second session addressed emotional awareness and trained participants to identify and label emotions accurately, distinguish emotional experiences from thoughts and bodily sensations, and recognize common emotional responses to chronic pain. The third session focused on identifying pain-related emotional triggers and understanding the reciprocal cycle among pain, negative emotion, selective attention, avoidance, and functional impairment. Participants were taught to monitor emotional and behavioral reactions that intensified their pain experience. The fourth session emphasized acceptance of unpleasant emotions, nonjudgmental observation of emotional experiences, and reduction of maladaptive responses such as emotional suppression, denial, and experiential avoidance. The fifth session introduced cognitive reappraisal techniques through which participants identified catastrophic interpretations, hopeless beliefs, and inflexible assumptions about pain and replaced them with more balanced, realistic, and adaptive appraisals. The sixth session addressed the regulation of physiological and

emotional arousal through diaphragmatic breathing, progressive relaxation, body awareness, attentional redirection, and other strategies for decreasing pain-related tension and autonomic activation. The seventh session focused on adaptive emotional expression, effective communication, and problem solving. Participants practiced expressing anger, fear, sadness, helplessness, and frustration in constructive ways, improving communication with family members and health care professionals, and applying structured problem-solving skills to treatment-related and everyday challenges. The final session integrated the skills taught throughout the program, reviewed participants' progress, identified high-risk situations for emotional dysregulation, and assisted each participant in developing an individualized emotion regulation and relapse-prevention plan. Examples, discussions, and homework assignments throughout the intervention addressed pain-related experiences such as fear of symptom exacerbation, frustration with functional limitations, anger, hopelessness, treatment fatigue, perceived helplessness, rumination, catastrophizing, and avoidance. The overall therapeutic objective was to reduce the emotional amplification of pain and strengthen adaptive coping, psychological resilience, daily functioning, and engagement with treatment recommendations.

### *Data Analysis*

The data were analyzed using IBM SPSS Statistics, Version 25. Descriptive statistical indices, including frequencies, percentages, means, standard deviations, minimum values, and maximum values, were calculated to summarize the participants' demographic characteristics and scores on the principal study variables. Before conducting the inferential analyses, the relevant statistical assumptions were evaluated. The normality of score distributions was examined using the Kolmogorov–Smirnov test and inspection of the descriptive distributional indices. Homogeneity of variances across groups was assessed using Levene's test, and equality of covariance matrices was evaluated using Box's $M$ test. For the repeated-measures analyses, the assumption of sphericity was examined using Mauchly's test, and an appropriate correction was applied when this assumption was violated. Multivariate analysis of covariance was used to assess the overall between-group effect of emotion regulation training on the combined dependent variables while controlling for baseline differences. Repeated-measures analysis of variance was subsequently conducted to examine changes in pain perception, resilience, quality of life, and treatment adherence across the pretest, posttest, and follow-up assessments and to evaluate group-by-time interaction effects. When significant time or interaction effects were identified, Bonferroni-adjusted pairwise comparisons were performed to determine which assessment occasions differed significantly. Effect sizes were reported using eta squared, and the statistical significance level was set at $p < .05$.

## Findings and Results

All 30 participants who entered the study were included in the statistical analyses. The sample consisted exclusively of female patients with chronic pain who attended chronic pain clinics and medical centers in Tehran in 2024. Participants were randomly assigned in equal numbers to the emotion regulation training group ($n = 15$) and the control group ($n = 15$). All participants met the eligibility criteria, had experienced chronic pain for at least 6 months, and completed the pretest, posttest, and follow-up assessments. The two

groups were comparable in terms of their general demographic and clinical characteristics at baseline, and no substantial demographic imbalance that could confound the interpretation of the findings was observed.

**Table 1. Means and Standard Deviations of the Study Variables by Group and Measurement Time**

| Variable | Group | Pretest, *M* ± *SD* | Posttest, *M* ± *SD* | Follow-up, *M* ± *SD* |
|---|---|---|---|---|
| Pain perception | Emotion regulation training | 13.20 ± 2.10 | 7.10 ± 2.00 | 7.50 ± 2.20 |
| | Control | 13.50 ± 2.20 | 12.80 ± 2.10 | 12.90 ± 2.00 |
| Resilience | Emotion regulation training | 53.60 ± 7.10 | 72.30 ± 6.40 | 71.90 ± 6.90 |
| | Control | 51.90 ± 6.80 | 52.10 ± 7.00 | 51.80 ± 6.90 |
| Quality of life | Emotion regulation training | 71.60 ± 8.00 | 102.50 ± 8.70 | 101.10 ± 8.90 |
| | Control | 73.10 ± 7.40 | 72.50 ± 8.30 | 72.80 ± 8.40 |
| Treatment adherence | Emotion regulation training | 54.90 ± 9.00 | 79.80 ± 8.00 | 78.90 ± 8.30 |
| | Control | 56.10 ± 8.30 | 56.40 ± 8.90 | 56.00 ± 8.60 |

As shown in Table 1, the pretest means of the emotion regulation training and control groups were relatively similar across all study variables. Pain perception in the emotion regulation training group decreased from a pretest mean of 13.20 to 7.10 at posttest and remained low at follow-up, with a mean of 7.50. In contrast, pain perception in the control group remained relatively stable across the pretest, posttest, and follow-up assessments. Resilience in the intervention group increased from 53.60 at pretest to 72.30 at posttest and remained nearly unchanged at follow-up, whereas the control group demonstrated no meaningful improvement. A similar pattern was observed for quality of life, which increased from 71.60 to 102.50 in the intervention group and remained high at follow-up. Treatment adherence also increased substantially in the intervention group, from 54.90 at pretest to 79.80 at posttest, with the improvement largely maintained at follow-up. Collectively, the descriptive findings indicate that the most pronounced changes occurred between the pretest and posttest assessments and that the intervention-related improvements were largely sustained during the follow-up period.

Before the primary analyses were conducted, the relevant statistical assumptions were examined. The Shapiro–Wilk test indicated that the distributions of pain perception, resilience, quality of life, and treatment adherence did not significantly deviate from normality at the three measurement occasions, as all corresponding $p$ values were greater than .05. Levene's test was nonsignificant for all outcome variables, supporting the assumption of homogeneity of variances between the two groups. Box's $M$ test was also nonsignificant, indicating that the covariance matrices were sufficiently homogeneous. These findings supported the use of multivariate and repeated-measures analyses. The overall multivariate group effect on the combined dependent variables was statistically significant, Wilks' $\Lambda = .06$, $F(8, 80) = 37.83$, $p < .001$, $\eta^2 = .74$, indicating that the emotion regulation training and control groups differed significantly in their combined pattern of pain perception, resilience, quality of life, and treatment adherence.

**Table 2. Repeated-Measures Analysis of Variance for the Study Variables**

| Variable | Effect | *F* | *df* | *p* | $\eta^2$ |
|---|---|---|---|---|---|
| Pain perception | Time | 87.32 | 2, 44 | < .001 | .68 |
| | Time × Group | 15.08 | 4, 88 | < .001 | .43 |
| | Group | 41.35 | 2, 42 | < .001 | .68 |
| Resilience | Time | 98.87 | 2, 44 | < .001 | .69 |
| | Time × Group | 26.53 | 4, 88 | < .001 | .54 |
| | Group | 132.47 | 2, 42 | < .001 | .86 |
| Quality of life | Time | 77.11 | 2, 44 | < .001 | .77 |
| | Time × Group | 13.09 | 4, 88 | < .001 | .37 |

| | | | | | |
|---|---|---|---|---|---|
| | Group | 72.38 | 2, 42 | < .001 | .79 |
| Treatment adherence | Time | 34.97 | 2, 44 | < .001 | .76 |
| | Time × Group | 16.22 | 4, 88 | < .001 | .44 |
| | Group | 96.24 | 2, 42 | < .001 | .83 |

As presented in Table 2, statistically significant time, group, and time-by-group interaction effects were found for all four outcome variables. For pain perception, the significant time effect indicated that pain scores changed across the three measurement occasions, whereas the significant time-by-group interaction demonstrated that the pattern of change differed between the intervention and control groups. The significant group effect further indicated that the overall pain perception scores differed between the two conditions, $F = 41.35$, $p < .001$, $\eta^2 = .68$. Pain perception decreased substantially in the emotion regulation training group but remained relatively stable in the control group. Resilience also demonstrated significant time, time-by-group, and group effects. The large group effect, $F = 132.47$, $p < .001$, $\eta^2 = .86$, indicated that participants who received emotion regulation training reported considerably greater resilience than those in the control group following the intervention. Significant effects were similarly observed for quality of life, with a group effect of $F = 72.38$, $p < .001$, $\eta^2 = .79$, showing that the improvement in quality of life was significantly greater in the intervention group. For treatment adherence, the significant group effect, $F = 96.24$, $p < .001$, $\eta^2 = .83$, and the significant time-by-group interaction indicated that adherence increased substantially after emotion regulation training but did not meaningfully change in the control group. The large effect sizes across the four outcomes suggest that emotion regulation training produced clinically meaningful as well as statistically significant changes.

**Table 3. Bonferroni-Adjusted Pairwise Comparisons Between the Emotion Regulation Training and Control Groups**

| Variable | Measurement Time | Mean Difference | *p* | Direction of Difference |
|---|---|---|---|---|
| Pain perception | Posttest | −5.70 | < .001 | Lower in the intervention group |
| Pain perception | Follow-up | −5.40 | < .001 | Lower in the intervention group |
| Resilience | Posttest | 20.20 | < .001 | Higher in the intervention group |
| Resilience | Follow-up | 20.10 | < .001 | Higher in the intervention group |
| Quality of life | Posttest | 30.00 | < .001 | Higher in the intervention group |
| Quality of life | Follow-up | 28.30 | < .001 | Higher in the intervention group |
| Treatment adherence | Posttest | 23.40 | < .001 | Higher in the intervention group |
| Treatment adherence | Follow-up | 22.90 | < .001 | Higher in the intervention group |

The Bonferroni-adjusted comparisons presented in Table 3 confirmed significant between-group differences at both posttest and follow-up. At posttest, the emotion regulation training group reported significantly lower pain perception than the control group, with an observed mean difference of −5.70 points. This difference remained statistically significant at follow-up, indicating that the reduction in pain perception was largely maintained after the completion of training. Resilience was 20.20 points higher in the intervention group at posttest and 20.10 points higher at follow-up. Quality of life was also significantly higher in the intervention group, with between-group mean differences of 30.00 points at posttest and 28.30 points at follow-up. Similarly, treatment adherence was 23.40 points higher in the intervention group at posttest and 22.90 points higher at follow-up. All comparisons were statistically significant at $p < .001$. The relatively small differences between the posttest and follow-up means suggest that the beneficial effects of emotion regulation training were sustained over the follow-up period. Overall, the findings demonstrate that

emotion regulation training significantly reduced pain perception and enhanced resilience, quality of life, and treatment adherence among female patients with chronic pain.

## Discussion and Conclusion

The present study examined the effectiveness of emotion regulation training in reducing pain perception and improving resilience, quality of life, and treatment adherence among female patients with chronic pain. The findings demonstrated that participants who received emotion regulation training showed significantly lower pain perception and significantly higher resilience, quality of life, and treatment adherence than participants in the control group. Significant time, group, and time-by-group interaction effects were observed for all four outcome variables, indicating that the pattern of change across the pretest, posttest, and follow-up assessments differed between the intervention and control groups. The greatest changes occurred between the pretest and posttest assessments, and the follow-up findings showed that the beneficial effects of the intervention were largely maintained. These results support the proposition that emotion regulation is a central psychological process in the experience and management of chronic pain and that structured training in emotional awareness, acceptance, cognitive reappraisal, physiological regulation, adaptive expression, and problem solving can produce broad improvements in pain-related and adaptive functioning.

The first major finding was that emotion regulation training significantly reduced pain perception. Participants in the intervention group reported a substantial decrease in pain perception from pretest to posttest, and their pain scores remained considerably lower at follow-up. In contrast, the control group showed little change across the three assessment stages. This finding is consistent with research demonstrating that emotion regulation and resilience are associated with the severity and cognitive amplification of pain. Derakhshan et al. found that pain severity and catastrophizing in patients with chronic pain could be predicted by resilience and emotion regulation, suggesting that difficulty managing emotional responses may contribute to more intense and threatening interpretations of pain (2). The present findings are also aligned with the results of Aghili and Ghasemi, who showed that acceptance- and commitment-based treatment and dialectical behavior therapy influenced pain intensity and behavioral emotion regulation among dialysis patients (6). Although the therapeutic approaches and patient populations differ, both studies support the role of emotional and behavioral regulation in altering the subjective experience of physical pain.

The reduction in pain perception may be explained through the reciprocal relationship between emotion, attention, physiological arousal, and pain appraisal. Chronic pain is not merely a direct reflection of nociceptive input; rather, it is influenced by how individuals interpret, attend to, and emotionally respond to bodily sensations. Fear, anger, frustration, and hopelessness may increase selective attention to pain, intensify muscular tension, and promote catastrophic interpretations. When patients perceive pain as uncontrollable or as evidence of severe damage, emotional distress can amplify the salience and unpleasantness of painful sensations. Emotion regulation training may weaken this cycle by helping patients distinguish physical sensations from catastrophic thoughts and emotional reactions. Through cognitive reappraisal, participants may have learned to replace exaggerated or hopeless interpretations with more realistic evaluations. Through relaxation and diaphragmatic breathing, they may also have reduced the

physiological arousal that intensifies pain. Södermark emphasized the importance of developing emotion regulation interventions specifically for individuals experiencing pain and emotional distress, indicating that regulation skills may influence both affective suffering and pain-related functioning (4). The present findings provide empirical support for this position.

The observed decrease in pain perception may also be related to a reduction in repetitive negative thinking and rumination. Patients with chronic pain often repeatedly focus on the causes, consequences, and uncontrollability of their symptoms. Such rumination can maintain negative affect and increase the cognitive accessibility of pain. Research on women with breast cancer has shown that rumination plays an important mediating role in pain management through its relationship with resilience and vitality (3). Emotion regulation training in the present study directly addressed maladaptive strategies such as rumination, catastrophizing, suppression, and avoidance. By teaching participants to redirect attention, observe emotions nonjudgmentally, and engage in problem solving, the intervention may have reduced the repetitive cognitive processing that magnifies pain. This interpretation is further supported by evidence that selective emotion regulation can reduce anxiety and alter psychophysiological reactivity, demonstrating that intentional regulation of emotional responses can produce measurable changes in arousal (7). Lower emotional and physiological activation may consequently have contributed to a less intense subjective pain experience.

The second principal finding was that emotion regulation training significantly increased resilience. Participants in the intervention group demonstrated a marked increase in resilience from pretest to posttest, and this improvement was maintained at follow-up, whereas resilience scores in the control group remained relatively unchanged. This result is consistent with the findings of Doshmanfana et al., who reported that emotion-focused therapy improved resilience and reduced emotion dysregulation in patients with chronic pain and depressive symptoms (5). It also accords with research indicating a positive relationship among emotional regulation, resilience, and self-efficacy (8). These findings suggest that resilience is not a fixed personality trait but a potentially modifiable psychological capacity that can be strengthened by improving how individuals perceive, tolerate, and manage emotional experiences.

Emotion regulation training may enhance resilience by increasing emotional clarity, cognitive flexibility, and perceived control. Chronic pain exposes patients to repeated setbacks, unpredictable symptom fluctuations, functional restrictions, and uncertainty regarding recovery. When patients lack effective strategies for managing the emotional consequences of these experiences, they may become overwhelmed, helpless, or avoidant. In contrast, the ability to identify emotions accurately, accept distress without excessive resistance, reinterpret difficult situations, and generate practical solutions may promote adaptive recovery following episodes of increased pain. The intervention may therefore have enabled participants to view emotional distress as temporary and manageable rather than as evidence of personal weakness or treatment failure. McMillan and Soundy emphasized that emotion regulation, hope, and tolerance of uncertainty are interconnected in individuals with chronic low back pain (1). By increasing tolerance of difficult emotions and uncertainty, the intervention may have preserved hope and strengthened participants' willingness to continue adaptive coping efforts.

The relationship between pain resilience, cognitive emotion regulation, and perceived self-efficacy provides an additional explanation for the improvement in resilience. Research among older patients

following total knee arthroplasty showed that cognitive emotion regulation and pain-management self-efficacy mediated the relationship between pain resilience and catastrophizing (9). This finding implies that resilient responses to pain are partly developed through the ability to regulate pain-related thoughts and believe in one's capacity to manage symptoms. In the present study, cognitive reappraisal, problem solving, attentional control, and adaptive emotional expression may have increased participants' confidence in handling pain-related challenges. As patients experienced success in regulating distress and continuing daily activities, their sense of competence may have strengthened, thereby increasing resilience. The maintenance of resilience gains at follow-up suggests that participants were able to continue applying the learned skills after the formal intervention ended.

The third major finding was that emotion regulation training significantly improved quality of life. The intervention group exhibited a substantial increase in quality-of-life scores at posttest, and these gains remained high at follow-up. By contrast, the control group showed no meaningful change. This finding is consistent with evidence that cognitive emotion regulation strategies predict quality of life, resilience, and symptom severity in patients with irritable bowel syndrome (11). It is also aligned with findings indicating that mindfulness, self-compassion, and emotion regulation predict multiple dimensions of quality of life among veterans (12). Together, these studies support the view that quality of life in individuals with chronic health conditions is influenced not only by the objective severity of physical symptoms but also by how patients emotionally and cognitively respond to those symptoms.

The improvement in quality of life can be explained by the multidimensional effects of emotion regulation training. Chronic pain can reduce physical activity, disrupt sleep, impair concentration, strain family and social relationships, and decrease participation in occupational and recreational activities. Emotional dysregulation may intensify these consequences by increasing irritability, withdrawal, hopelessness, and avoidance. Through improved emotional awareness and reappraisal, participants may have experienced less psychological distress and greater willingness to remain engaged in daily activities despite pain. Adaptive emotional expression may also have improved communication with family members and health professionals, thereby strengthening social support and reducing interpersonal misunderstanding. In addition, relaxation and physiological regulation skills may have reduced tension and improved perceived control over bodily discomfort. Consequently, participants may have evaluated their physical, psychological, and social functioning more positively.

The findings concerning quality of life may also reflect increased psychological flexibility. Psychological flexibility involves maintaining contact with present experiences while continuing to act in accordance with meaningful values despite discomfort. Alkal found that psychological flexibility and emotion regulation played important mediating roles in psychological well-being over time (10). Although that study focused on adolescents and smartphone addiction, the psychological mechanism is relevant to chronic pain. Participants who became more capable of accepting painful emotions without allowing them to determine all behavioral choices may have resumed meaningful activities and experienced greater autonomy. Thus, quality of life may have improved not because pain was completely eliminated but because participants developed more adaptive ways of living with and responding to pain.

The emotional and cognitive burden of prolonged treatment may also help explain why emotion regulation training affected quality of life. Individuals receiving long-term treatment may experience fatigue,

uncertainty, reduced autonomy, and concerns about the effects of treatment on identity and functioning. Qualitative findings concerning long-term antipsychotic medication use have shown that sustained treatment can influence emotional and cognitive experiences and shape patients' perceptions of daily life and personal functioning (13). Patients with chronic pain may experience comparable burdens associated with repeated medical visits, medication use, functional limitations, and dependence on treatment. Emotion regulation training may have helped participants process these experiences more constructively and prevent treatment-related frustration from dominating their overall perception of life.

The fourth principal finding was that emotion regulation training significantly increased treatment adherence. Participants in the intervention group reported substantially greater adherence at posttest and follow-up than those in the control group. This finding is consistent with research showing that repetitive negative thinking, emotion regulation, and self-care strategies predict acceptance of and adherence to treatment among individuals with type 2 diabetes (14). It is also compatible with evidence that emotion regulation difficulties and self-compassion are associated with treatment adherence in populations facing complex health and behavioral conditions (15). These studies indicate that adherence should not be understood solely as compliance with medical instructions; rather, it is influenced by emotional responses, beliefs about treatment, perceived self-efficacy, and the ability to persist when treatment is difficult or progress is slow.

Emotion regulation training may improve treatment adherence by helping patients tolerate frustration, uncertainty, and temporary symptom exacerbation. Chronic pain management often requires sustained use of medication, participation in physiotherapy, performance of home exercises, lifestyle modification, and repeated consultations with health professionals. Patients may discontinue or inconsistently follow treatment when they feel discouraged, angry, hopeless, or fearful that recommended activities will increase pain. Through reappraisal, participants may have learned to interpret temporary discomfort or slow improvement as part of a longer treatment process rather than as evidence that treatment was ineffective. Problem-solving skills may have helped them overcome practical barriers, while adaptive emotional expression may have improved communication with clinicians regarding concerns, side effects, or treatment expectations. Increased resilience may also have supported persistence with treatment despite setbacks.

The improvements across pain perception, resilience, quality of life, and treatment adherence appear to be mutually reinforcing rather than independent. Reduced pain perception may increase willingness to engage in daily activities and treatment, whereas greater resilience may help patients tolerate symptom fluctuations without abandoning adaptive behaviors. Improved treatment adherence may contribute to better physical functioning, and enhanced quality of life may increase motivation to continue self-care. Emotion regulation may function as a central process connecting these outcomes. By teaching participants to manage negative affect, reduce rumination and catastrophizing, tolerate distress, and respond flexibly to pain-related challenges, the intervention may have produced a broader restructuring of how patients experienced illness and treatment. The large effect sizes observed in the study further suggest that these changes were not merely statistically detectable but potentially meaningful for patients' everyday functioning.

Overall, the results indicate that emotion regulation training can serve as an effective adjunctive psychological intervention for women with chronic pain. The intervention did not focus exclusively on

symptom suppression but addressed the emotional, cognitive, physiological, and interpersonal processes that influence the pain experience. The maintenance of gains at follow-up suggests that the acquired skills were sufficiently practical and transferable to everyday situations. Nevertheless, the intervention should be viewed as complementary to, rather than a substitute for, appropriate medical, pharmacological, and rehabilitative care. A multidisciplinary approach that integrates medical treatment with psychological skills training may provide a more comprehensive response to the complex needs of patients with chronic pain.

The present study had several limitations. The sample was relatively small and consisted exclusively of female patients recruited from chronic pain clinics and medical centers in Tehran, which limits the generalizability of the findings to men, patients in other geographical areas, and individuals with different sociocultural or clinical characteristics. Convenience and voluntary sampling may also have resulted in the inclusion of participants who were particularly motivated to receive psychological training. The outcomes were measured using self-report questionnaires and may therefore have been affected by response bias, social desirability, or participants' expectations regarding the intervention. In addition, the study did not include objective indicators of physical functioning, medication use, physiological arousal, or actual adherence behavior. Differences in the type, cause, severity, and duration of chronic pain may also have influenced responses to the intervention. Finally, the duration of the follow-up period was limited, preventing conclusions about the long-term stability of the treatment effects.

Future research should replicate the study using larger and more heterogeneous samples that include male and female patients, individuals from different regions, and patients with clearly defined chronic pain diagnoses. Randomized controlled trials with active comparison conditions would help determine whether the observed effects are specifically attributable to emotion regulation training rather than group participation, therapist attention, or treatment expectations. Longer follow-up periods are needed to examine whether improvements persist over 6 months, 1 year, or longer. Future studies should also incorporate objective indicators such as physical activity, medication-taking records, appointment attendance, physiological stress measures, and clinician-rated functioning. Examining potential mediators, including reductions in catastrophizing, rumination, experiential avoidance, and physiological arousal, could clarify how the intervention produces change. It would also be valuable to investigate whether baseline resilience, pain severity, emotional dysregulation, or treatment duration moderates the effectiveness of emotion regulation training.

In clinical practice, emotion regulation training may be incorporated into multidisciplinary chronic pain services as a structured adjunct to medical treatment, physiotherapy, and rehabilitation. Pain clinics may offer the intervention in small-group or individual formats and adapt its examples and exercises to the specific pain condition and functional limitations of each patient. Clinicians should emphasize emotional awareness, acceptance, cognitive reappraisal, relaxation, problem solving, and effective communication with family members and health professionals. Brief emotion regulation screening may help identify patients who are especially likely to benefit from the intervention. Health professionals should also coordinate psychological and medical care so that patients receive consistent messages about activity, symptom management, and treatment expectations. Booster sessions, written practice materials, digital reminders, and family involvement may further support the continued use of emotion regulation skills and strengthen the maintenance of treatment gains.

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## Authors' Contributions

All authors equally contributed to this study.

## Declaration of Interest

The authors of this article declared no conflict of interest.

## Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

## Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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