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Effectiveness of a Neuropsychology-Based Therapeutic Package on Distress Tolerance and Emotional Ambivalence in Individuals with Multiple Sclerosis

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A B S T R A C T

Purpose: This study aimed to develop a neuropsychology-based therapeutic package for individuals with multiple sclerosis and evaluate its effectiveness in improving distress tolerance and reducing emotional ambivalence.

Methods and Materials: This mixed-methods research was conducted using a sequential exploratory design. In the qualitative phase, semi-structured interviews with neurologists were analyzed through directed content analysis to identify the key cognitive, emotional, and self-management components required for a neuropsychological intervention. Based on the extracted codes and categories, a structured 12-session therapeutic protocol was developed. In the quantitative phase, a quasi-experimental design with pre-test, post-test, and two-month follow-up was implemented with an experimental group receiving the neuropsychology-based intervention and a control group receiving standard care. Validated scales of distress tolerance and emotional ambivalence were administered across all timepoints, and data were analyzed using mixed ANOVA and Bonferroni post hoc tests.

Findings: Mixed ANOVA results indicated significant group × time interaction effects for total distress tolerance ($F = 36.75$, $p < .001$, $\eta^2 = .43$) and total emotional ambivalence ($F = 30.77$, $p < .001$, $\eta^2 = .40$), demonstrating the superiority of the intervention over standard care. Bonferroni post hoc comparisons revealed significant improvements in the experimental group from pre-test to post-test ($p < .001$) for both variables, with gains largely maintained at follow-up ($p > .05$ for post-test to follow-up), while the control group showed no significant changes across timepoints ($p > .74$).

Conclusion: The neuropsychology-based therapeutic package demonstrated strong and sustained effects in enhancing distress tolerance and reducing emotional ambivalence among individuals with multiple sclerosis. Integrating cognitive rehabilitation, emotional regulation training, mindfulness, communication skills, and self-management strategies offers a comprehensive and effective approach for addressing the complex cognitive-emotional challenges associated with the condition.

Keywords: *Multiple sclerosis; neuropsychology-based intervention; distress tolerance; emotional ambivalence; cognitive rehabilitation; emotion regulation*

1. Introduction

Multiple sclerosis (MS) is a chronic, progressive, immune-mediated neurodegenerative disease affecting the central nervous system and characterized by demyelination, axonal loss, and a wide range of cognitive, emotional, and behavioral symptoms that substantially impair daily functioning and quality of life (Marsool et al., 2024). Epidemiological evidence highlights the global burden and rising prevalence of MS, with new demographic patterns emerging even among younger populations, as shown in recent pediatric incidence studies (Sandesjö et al., 2024). Beyond its neurological manifestations, MS is increasingly recognized as a complex biopsychosocial condition in which neuroinflammatory processes interact with cognitive deficits, emotional dysregulation, and psychosocial stressors, underscoring the need for integrative therapeutic approaches (Schlindwein et al., 2024). Environmental and lifestyle risk factors, such as exposure to tobacco smoke, have also been implicated in exacerbating disease progression and may contribute to heightened emotional reactivity and reduced neurocognitive resilience (Schlindwein et al., 2024). These complexities illustrate why MS is not merely a physical illness but a disorder deeply intertwined with cognitive-emotional functioning.

Cognitive and emotional disturbances constitute some of the most debilitating non-motor symptoms in MS. Research indicates that impairments in working memory, attention, executive functioning, and information processing speed are prevalent across disease stages and significantly hinder adaptation and autonomy (Cuerda-Ballester et al., 2023). Emotional alterations—including increased emotional intensity, reduced emotion recognition ability, and heightened sensitivity to stress—have also been well documented (Pfaff et al., 2021). Neuroimaging studies further demonstrate structural and functional abnormalities in emotion-regulation networks, showing altered connectivity in regions associated with alexithymia, affective processing, and cognitive control, suggesting that emotional dysregulation in MS may arise directly from neurobiological changes rather than solely psychological adaptation failures (Van Assche et al., 2021). Additionally, deficits in emotion perception and social cognition have been linked with diminished interpersonal functioning and lower quality of life (Radlak et al., 2021). These findings collectively highlight the need for therapeutic programs that simultaneously target cognitive rehabilitation and emotion regulation capacities.

A notable psychological challenge in MS is distress intolerance, defined as the perceived or actual inability to withstand emotional or physical discomfort. Research consistently shows that patients with MS report significantly lower distress tolerance compared with healthy individuals (Azami et al., 2019). Low distress tolerance contributes to maladaptive coping strategies, heightened emotional vulnerability, and greater risk for depression and anxiety (Dennison et al., 2009). Emotional dysregulation—another prevalent difficulty—is often exacerbated by fatigue, cognitive overload, and fluctuating neurological symptoms (Brands et al., 2018). Studies further show that the interaction between cognitive deficits and emotional reactivity may amplify maladaptive appraisal processes, increasing catastrophizing, avoidance, and negative meta-emotions (Naderipour et al., 2022). These emotional challenges may also emerge from disease-related trauma, with individuals experiencing profound disruptions in identity, bodily control, and social functioning, leading to prolonged emotional turmoil and impaired growth processes (Zeinali Siyavashani & Dehghan, 2021).

Given these emotional and cognitive vulnerabilities, recent studies emphasize the relevance of psychological flexibility and adaptive coping strategies in promoting better adjustment to MS. Research shows that emotion regulation, self-efficacy, and acceptance-based coping significantly predict healthier living, better management of symptoms, and improved functioning (Dehghan et al., 2023). Similarly, difficulties in emotional expression and ambivalence about sharing emotions can hinder interpersonal relationships and lead to social withdrawal, further reinforcing emotional instability (Zeinali Siyavashani & Dehghan, 2021). Cognitive-behavioral mechanisms also play a key role in MS adaptation; for example, maladaptive appraisal styles have been linked with heightened distress, while positive coping strategies predict greater resilience and life satisfaction (Brands et al., 2018).

In recent years, various therapeutic approaches have been applied to MS populations, including Acceptance and Commitment Therapy (ACT), Mindfulness-Based Cognitive Therapy (MBCT), compassion-based therapies, and emotion-focused therapy. ACT has demonstrated promising results in improving emotional dysregulation, distress tolerance, meaning in life, and pain self-efficacy among individuals with MS (Alizadeh et al., 2023; Shareh et al., 2019). Pilot studies in rehabilitation medicine have also shown ACT to be feasible and beneficial for MS patients, improving psychological adjustment and functioning

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(Nordin & Rorsman, 2011). Mindfulness-based interventions have similarly shown reductions in anxiety sensitivity and improvements in emotion regulation (Dizaj Khalili et al., 2023). Moreover, mindfulness appears to enhance self-compassion, distress tolerance, and emotional stability, making it a strong candidate for integrated treatment approaches (Falahichamachar & Razavi, 2023). Compassion-based and mindfulness-based therapies also reduce dysfunctional communication beliefs, thereby contributing to more adaptive interpersonal functioning among MS patients (Moeinzadeh et al., 2025). Emotion-focused therapy has shown efficacy in improving psychological capital and promoting post-traumatic growth in women with MS, highlighting the potential of experiential, emotion-centered approaches (Ebrahimi et al., 2022).

Despite these advances, there is still a significant gap in interventions that directly integrate neuropsychological principles with emotional regulation strategies. While some therapies address emotional distress and others target cognitive dysfunction, few programs are designed to simultaneously rehabilitate cognitive mechanisms—such as working memory, sustained attention, and executive functioning—while also strengthening emotional control systems. Research on the interplay between motor impairment, cognitive decline, and emotional disturbance further underscores this need by showing that these domains are interdependent and often decline concurrently (Cuerda-Ballester et al., 2023). Additionally, MS patients may struggle with emotional ambivalence—the experience of conflicting feelings regarding emotional expression—which can impede communication, interpersonal connection, and adaptive coping (Pfaff et al., 2021). Addressing this ambivalence requires a therapeutic framework that enhances insight, emotional clarity, and confidence in expressing emotions appropriately.

Neuropsychology-based therapeutic approaches provide a promising avenue for integrating cognitive remediation with emotional regulation. Such interventions draw upon neurobiological principles, cognitive training methods, and psychological strategies for strengthening adaptive functioning across interconnected brain systems. They may include working-memory exercises, attentional control practices, problem-solving strategies, mindfulness training, and restructuring of maladaptive beliefs. Evidence suggests that cognitive rehabilitation can improve efficiency in attentional networks, enhance executive functioning, and reduce cognitive fatigue—all of which are foundational for emotional stability (Cuerda-Ballester et al., 2023). Meanwhile, emotion-regulation strategies grounded in neuropsychology can help recalibrate hyperreactive limbic responses and promote greater prefrontal control, leading to improved distress tolerance and reduced emotional ambivalence.

Moreover, the psychosocial dimensions of MS strongly support the development of interventions that enhance social functioning, self-management, and communication abilities. Studies highlight that MS patients often face disrupted interpersonal relationships and social participation due to emotional dysregulation and communication difficulties (Radlak et al., 2021). Therapeutic programs that strengthen assertive communication, improve emotional expressiveness, and foster social support networks may therefore serve as a protective buffer against psychological distress and disease-related decline. Importantly, self-management skills—including symptom monitoring, fatigue regulation, and long-term planning—have been identified as crucial for maintaining optimal functioning and preventing exacerbations (Dehghan et al., 2023). Integrating these components into a comprehensive neuropsychology-based intervention may yield more enduring improvements across multiple domains of functioning.

A further consideration is the heterogeneity of MS, which varies widely in symptom presentation, progression patterns, and psychological responses. This variability reinforces the importance of personalized, flexible treatment models that accommodate individual needs and capitalize on neuropsychological strengths. Research on disease-specific coping styles reveals that MS patients often respond differently to stress and emotional difficulty compared with individuals with other neurological conditions, suggesting that tailored therapeutic models may outperform generic psychological interventions (Brands et al., 2018). Additionally, systematic reviews underscore that psychological and environmental factors can significantly influence the onset, progression, and quality of life outcomes in MS, supporting an integrative biopsychosocial treatment framework (Schlindwein et al., 2024).

Taken together, the existing literature demonstrates a strong need for innovative interventions that integrate cognitive rehabilitation, emotional regulation, neuropsychological principles, and self-management skills into a unified therapeutic model for MS. Although ACT, mindfulness-based interventions, and compassion-focused therapies each offer important benefits, none provide a comprehensive, neuropsychologically grounded structure

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specifically designed to reduce distress intolerance and emotional ambivalence while strengthening cognitive-emotional functioning. Given the complex and multidimensional nature of MS, a neuropsychology-based therapeutic package may offer a more holistic and targeted approach to addressing these interrelated challenges. Such a program can potentially yield meaningful, sustainable improvements in both cognitive performance and emotional well-being.

The aim of the present study is to develop a neuropsychology-based therapeutic package for individuals with multiple sclerosis and evaluate its effectiveness on distress tolerance and emotional ambivalence.

2. Methods and Materials

2.1. Study Design and Participants

The present research employed a sequential exploratory mixed-methods design, chosen to align with the dual purpose of developing a neuropsychology-based therapeutic package for individuals with multiple sclerosis (MS) and subsequently evaluating its clinical effectiveness in comparison with Acceptance and Commitment Therapy (ACT). In this design, qualitative data collection and analysis precede the quantitative phase, allowing for an evidence-grounded intervention protocol that emerges directly from expert experiences. The qualitative phase focused on eliciting in-depth insights from neurologists and specialists in neuropsychology and health psychology who possess substantial clinical experience with MS patients. These experts were selected because they represent a rich source of tacit knowledge regarding patients' cognitive-emotional challenges, treatment gaps, and therapeutic potentials. Semi-structured interviews were conducted until thematic saturation was achieved after ten interviews, although twelve interviews were completed in total to ensure comprehensiveness. The interviews took place in the neurologists' private offices following appointment scheduling and verbal consent. Participants first completed a demographic information form, after which interviews lasting between thirty-five and sixty minutes were conducted, recorded with permission, and accompanied by field notes. Inclusion criteria for experts consisted of at least five years of professional experience treating or researching MS, familiarity with neuropsychological therapeutic approaches, and substantial clinical involvement with MS patients. Exclusion criteria included lack of willingness to continue participation, prolonged interruptions in the interview process, non-relevant responses, or acute medical or psychiatric conditions interfering with participation.

The quantitative phase was conducted following the development and validation of the neuropsychology-based 12-session protocol. This phase used a quasi-experimental design with pretest, posttest, and two-month follow-up assessments across three groups: an experimental group receiving the neuropsychology-based intervention, a comparison group receiving ACT, and a control group receiving standard care. Sample size estimation was performed using Cochran's formula and G*Power software to ensure adequate power for MANCOVA analyses. With an assumed alpha level of .05, statistical power of .80, and the need to compare three groups, a sample size of approximately fifteen to twenty participants per group was determined as sufficient, with additional allowance for potential attrition. Participants in the quantitative phase were selected through convenience sampling based on eligibility criteria and subsequently allocated randomly to the three groups. Inclusion criteria included confirmed diagnosis of MS by a neurologist, age between eighteen and sixty years, ability to attend regular therapy sessions, absence of concurrent psychological interventions, and adequate literacy to complete questionnaires. Exclusion criteria consisted of missing more than two therapy sessions, voluntary withdrawal, initiation or modification of psychological or pharmacological treatments during the study, acute clinical relapse, or failure to complete required assessments.

2.2. Measures

The qualitative phase utilized multiple complementary instruments to ensure depth, richness, and methodological rigor. The primary tool was a semi-structured interview guide specifically developed to explore experts' lived experiences, clinical observations, and theoretical perspectives relevant to designing a neuropsychology-informed intervention. This guide covered domains such as cognitive-emotional dysregulation, neural mechanisms relevant to MS, therapeutic needs, and recommendations for session-level intervention strategies. A demographic information form gathered professional background characteristics, while systematic field notes captured contextual details and nonverbal cues. All interviews were audio recorded and transcribed verbatim to enhance analytic precision. MAXQDA 2022 software was employed to

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facilitate iterative coding, data organization, and comparative analysis.

To validate the therapeutic protocol derived from qualitative findings, four complementary validation strategies were implemented: fidelity assessment, Delphi expert consensus, participant feedback, and Lincoln–Guba content validity evaluation. Fidelity assessment involved structured checklists completed after each session to determine adherence to session objectives, appropriate delivery of cognitive-emotional techniques, execution of experiential activities, and participants' engagement. Delphi evaluation consisted of two rounds of expert review by neurologists and clinical psychologists, who rated clarity, necessity, practicality, and scientific grounding of each session's content and structure, achieving over eighty percent agreement. Participant feedback was collected using a ten-item Likert-based questionnaire assessing acceptability, comprehensibility, ease of participation, perceived usefulness, and satisfaction. Content validity was further examined using the CVR and CVI indices following review by twelve specialists, confirming adequate validity for all twelve sessions.

Quantitative data collection relied on standardized psychological measures. Distress tolerance was assessed using the Distress Tolerance Scale (DTS) developed by Simons and Gaher (2005), a fifteen-item self-report instrument measuring emotional tolerance, absorption by negative affect, appraisal of distress, and regulation efforts. This scale demonstrates strong internal consistency, test-retest reliability, and convergent validity. Ambivalence in emotional expression was measured using the King and Emmons (1990) Ambivalence Over Emotional Expression Questionnaire, which consists of twenty-three items in its validated Iranian version and evaluates ambivalence regarding both positive and negative emotional expression. This measure has robust psychometric properties across cultural contexts, including strong internal reliability and construct validity. All questionnaires were administered in pretest, posttest, and follow-up stages.

2.3. Data Analysis

Qualitative data analysis followed a directed content analysis approach, chosen because the study was grounded in existing neuropsychological theories that guided the initial coding structure while still allowing emergent insights. Transcripts were first prepared through meticulous verbatim transcription, removal of identifying information, and repeated reading to ensure deep familiarization with the content. Initial coding involved extracting meaningful units related to key phenomena such as pain catastrophizing, distress tolerance, emotional ambivalence, cognitive-emotional regulation, and neuropsychological rehabilitation. These codes were subsequently grouped and refined into subcategories and major categories through axial coding, which allowed exploration of conceptual relationships and theoretical integration. Selective coding then identified core themes that formed the backbone of the treatment protocol. To enhance credibility and reliability, two independent researchers reviewed all codes and thematic structures, resolving discrepancies through discussion. Qualitative findings were presented as thematic clusters supported by exemplar quotations.

In the quantitative phase, statistical analyses were conducted using SPSS version 22. Descriptive statistics including means, standard deviations, frequencies, and percentages were calculated to summarize demographic and baseline characteristics. Inferential analyses aimed to evaluate intervention effects across the three groups and over time. A multivariate analysis of covariance (MANCOVA) was employed to compare posttest and follow-up scores while statistically controlling for pretest values, thereby reducing error variance and providing a more accurate assessment of treatment effects. Assumptions of multivariate normality, homogeneity of covariance matrices, and equality of regression slopes were examined prior to conducting MANCOVA. Significant multivariate results were followed by univariate ANCOVAs to identify specific outcome variables affected by the interventions. Effect sizes were computed to determine the magnitude of treatment impacts. Through this multi-layered analytic strategy, the study ensured a rigorous examination of whether the neuropsychology-based intervention produced superior improvements in distress tolerance and reductions in emotional ambivalence compared to ACT and standard care.

3. Findings and Results

The qualitative sample consisted of ten neurologists, including six men and four women, with an age range of 37 to 55 years and a mean age of approximately 45.3 years. Their professional experience in the field ranged from 10 to 28 years, with an average of 17.5 years, indicating a highly experienced expert panel. In terms of academic rank, three participants were full professors, four were associate professors, and three were assistant professors, and all of

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them specialized in neurology, which ensured that the therapeutic package was developed based on the views of senior clinicians with substantial expertise in the diagnosis and treatment of multiple sclerosis.

Table 1

Main Clusters and Sub-Clusters with Code Frequencies

Main Cluster	Sub-Cluster	Code Frequency
Cognitive Rehabilitation (55 codes)	Working memory	18
	Sustained attention	21
	Problem-solving	16
Emotion and Stress Regulation (55 codes)	Mindfulness	24
	Cognitive restructuring	19
	Communication skills	12
Education and Self-Management (30 codes)	Symptom monitoring	17
	Treatment-continuation planning	13
Social Support (24 codes)	Family	14
	Peer-support group	10

Analysis of the qualitative data resulted in the extraction of four main clusters and ten sub-clusters, demonstrating the multidimensional nature of therapeutic needs among individuals with multiple sclerosis. Cognitive Rehabilitation and Emotion–Stress Regulation each contributed fifty-five codes, indicating that experts consistently emphasized both cognitive strengthening and emotional stabilization as foundational pillars of treatment. Within cognitive rehabilitation, sustained attention (21 codes) and working memory (18 codes) emerged as the most frequently referenced cognitive targets, followed closely by problem-solving (16 codes). Emotion regulation components were also strongly represented, with mindfulness (24 codes) and cognitive restructuring (19 codes) appearing most prominently, highlighting their perceived centrality in managing MS-related emotional burden. Self-management elements accounted for thirty codes, with symptom monitoring (17 codes) reflecting the necessity of patient autonomy in disease management. Finally, social support components, including family involvement (14 codes) and peer support groups (10 codes), underscored the recognized value of interpersonal networks in sustaining treatment gains.

Table 2

Mapping Protocol Sessions to Main Clusters

Session	Dominant Cluster	Placement Description
1	Self-management and psychoeducation	Introduction and structural orientation
2	Cognitive rehabilitation	Working memory
3	Cognitive rehabilitation	Sustained attention
4	Cognitive rehabilitation	Problem-solving
5	Emotion regulation	Mindfulness
6	Emotion regulation	Cognitive restructuring
7	Social support	Communication skills
8	Self-management and psychoeducation	Fatigue management
9	Self-management and psychoeducation	Symptom monitoring
10	Self-management and psychoeducation	Treatment maintenance
11	Social support	Peer-support network

The mapping of protocol sessions to thematic clusters illustrates a structured and theoretically coherent distribution of therapeutic content across the intervention. Early sessions were intentionally designed to focus on psychoeducation and self-management, providing patients with foundational knowledge and preparing them for more skill-based work. Sessions two through four transition into cognitive rehabilitation, where core neuropsychological functions—working memory, sustained attention, and problem-solving—are systematically targeted, reflecting their high frequency in expert-derived qualitative codes. Mid-protocol sessions emphasize emotion regulation, integrating

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mindfulness and cognitive restructuring as essential skills for managing internal distress and reducing maladaptive responses. Sessions addressing social support appear at strategically placed intervals, enabling patients to strengthen communication skills and engage with peer-based resources that enhance resilience. The final sessions return to self-management themes such as symptom monitoring and treatment maintenance, ensuring long-term sustainability of gains and supporting the continuity of therapeutic progress beyond the formal program.

Table 3

Neuropsychology-Based Treatment Protocol Developed from Neurologists' Lived Experiences

Session	Main Theme / Focus	Session Objective	Therapeutic Content	Methods / Interventions	Homework
1	Introduction and Education	Familiarization with patients, identifying needs, foundational psychoeducation	Introducing session structure and goals; explaining the importance of cognitive rehabilitation, emotion regulation, and self-management	Group discussion, Q&A, introductory mindfulness practice	Daily energy and mood log; writing personal goals
2	Working Memory Enhancement	Improving working memory functioning	Repetitive short exercises; techniques for word and event recall	Memory games; individual and group practice	Five-minute daily memory practice; noting successes
3	Attention and Sustained Focus	Improving concentration and reducing distractibility	Teaching distraction management; dual-task exercises	Group attention tasks; focused breathing practice	Ten-minute daily focus exercise during routine activities
4	Problem-Solving and Decision-Making	Strengthening structured problem-solving in real situations	Presenting structured models of decision-making	Case analysis; group work	Solving one real-life problem and documenting the steps
5	Mindfulness and Relaxation	Reducing stress and emotional arousal	Teaching diaphragmatic breathing; mindfulness practices	Short meditation; practical exercises	Five minutes of daily breathing practice and diary
6	Cognitive Restructuring	Reducing negative thoughts and catastrophizing	Identifying maladaptive thoughts; replacing them with constructive beliefs	Cognitive restructuring using real examples	Recording three negative thoughts daily and rewriting adaptive versions
7	Communication Skills	Improving family and social relationships	Teaching assertiveness and conflict management	Role-play; group feedback	Practicing assertive communication with a close person and documenting it
8	Fatigue and Energy Management	Increasing resilience and reducing fatigue	Teaching pacing and activity planning	Weekly planning design; applied practice	Daily activity scheduling following pacing principles
9	Symptom Monitoring and Self-Care	Strengthening self-management and relapse prevention	Daily symptom tracking and trend analysis	Monitoring forms; practical exercises	Accurate daily recording of symptoms, mood, energy, and changes
10	Treatment Maintenance Planning	Consolidating learned skills	Long-term planning and sustaining interventions	Group discussion; individual plan development	Creating a two-week personalized maintenance plan
11	Social Support and Peer Network	Enhancing motivation and social support	Forming peer-support group; introducing supportive networks	Group activities; experience exchange	Contacting a peer-support member and documenting experience
12	Summary and Review	Reviewing and consolidating all skills	Reviewing sessions, gathering feedback, planning continuation	Group summary; skill-review exercises	Writing a long-term personal plan and setting future goals

The structure of the twelve-session neuropsychology-based protocol reflects a deliberate sequencing that begins with establishing foundational knowledge and rapport. The opening session focuses on orienting participants to the therapeutic process, clarifying expectations, and introducing core themes such as cognitive rehabilitation, emotional regulation, and self-management. This preparatory work is crucial for enhancing motivation and ensuring that participants understand the integrative nature of the intervention. Early sessions also emphasize psychoeducation, which serves as the bedrock for subsequent skill-building phases. By encouraging participants to track daily energy and mood, the protocol not only builds initial engagement but also introduces measurement-based care from the very beginning.

Sessions two through four concentrate on strengthening neurocognitive capacities frequently compromised in individuals with multiple sclerosis. Working memory,

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sustained attention, and structured problem-solving represent core cognitive functions that directly influence daily functioning, treatment adherence, and emotional stability. These sessions rely heavily on practical, exercise-based interventions such as memory games, dual-task training, and real-life problem analysis. The repeated use of applied activities ensures that cognitive skills are not taught in abstraction but practiced in contexts that mirror patients' daily experiences. Homework assignments at this stage reinforce neurocognitive exercise and promote generalization of skills beyond the therapeutic environment.

The middle phase of the protocol shifts toward emotional and physiological regulation, addressing common challenges such as stress sensitivity, negative automatic thinking, and emotional ambivalence. Sessions five and six provide a systematic approach to managing affective reactivity by integrating mindfulness practices and cognitive restructuring techniques. Participants learn to disengage from automatic emotional responses, recognize cognitive distortions, and replace maladaptive beliefs with more balanced interpretations. These sessions play a pivotal role in supporting the program's broader goal of reducing distress intolerance and improving emotional clarity. Home practices, such as daily breathing exercises and logging negative thoughts, encourage continuous self-reflection and strengthen emotional regulation capacity between sessions.

The final sessions emphasize long-term resilience and social integration—two essential domains for sustaining treatment gains in chronic neurological conditions. Sessions eight through twelve focus on fatigue management, symptom monitoring, treatment maintenance, and establishing meaningful social support systems. The inclusion of pacing strategies and relapse-prevention monitoring practices equips patients with concrete tools for managing physical and emotional fluctuations characteristic of multiple sclerosis. Additionally, the introduction of peer-support networks reinforces motivation, reduces isolation, and encourages shared coping strategies. By concluding with a comprehensive review and future-planning session, the protocol ensures that participants not only consolidate learned skills but also develop a personalized roadmap for ongoing growth and symptom management.

Table 4

Mean and Standard Deviation of Distress Tolerance and Emotional Ambivalence Across Three Measurement Points

Variable	Subscale	Group	Pre-test (M ± SD)	Post-test (M ± SD)	Two-month Follow-up (M ± SD)
Distress Tolerance	Tolerance	Experimental	31.00 ± 5.0	34.67 ± 5.3	33.80 ± 5.2
		Control	28.50 ± 4.9	28.93 ± 4.8	28.60 ± 4.7
	Appraisal	Experimental	29.00 ± 4.4	31.53 ± 4.6	30.80 ± 4.5
		Control	26.20 ± 4.1	26.30 ± 4.1	26.10 ± 4.0
	Absorption	Experimental	28.40 ± 4.5	32.40 ± 4.8	31.73 ± 4.6
		Control	27.60 ± 4.3	27.80 ± 4.4	27.50 ± 4.3
	Emotion Regulation	Experimental	26.80 ± 4.1	28.73 ± 3.9	28.20 ± 4.0
		Control	24.27 ± 3.8	24.40 ± 3.9	24.10 ± 3.8
	Total Distress Tolerance	Experimental	116.2 ± 12.5	127.7 ± 11.8	125.4 ± 12.1
		Control	113.8 ± 11.6	114.4 ± 11.7	113.9 ± 11.5
Emotional Ambivalence	Ambivalence in Negative Expression	Experimental	42.20 ± 5.2	36.40 ± 4.8	37.00 ± 5.0
		Control	41.20 ± 5.0	41.00 ± 4.9	41.10 ± 5.0
	Ambivalence in Positive Expression	Experimental	42.20 ± 4.8	36.87 ± 4.4	37.00 ± 4.9
		Control	39.67 ± 4.5	39.53 ± 4.5	39.57 ± 4.4
	Total Ambivalence	Experimental	82.40 ± 9.5	73.27 ± 8.9	74.00 ± 9.1
		Control	80.87 ± 9.3	80.53 ± 9.2	80.67 ± 9.1

The results presented in Table 4 demonstrate clear improvements in distress tolerance subscales among participants in the experimental group receiving the neuropsychology-based intervention. Across all four subcomponents—tolerance, appraisal, absorption, and emotion regulation—mean scores increased notably from pre-test to post-test, followed by slight reductions at follow-up that remained above baseline levels. In contrast, the control group displayed minimal change over time, suggesting that the targeted intervention was responsible for enhancing participants' capacity to endure emotional discomfort and maintain cognitive control in distressing situations. Notably, the total distress tolerance score in the experimental group increased from 116.2 to 127.7 at post-

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test, reflecting a substantial therapeutic effect that persisted reasonably well after two months.

A similar pattern of improvement is observed for ambivalence in emotional expression. Participants in the experimental group showed a marked reduction in ambivalence toward expressing both negative and positive emotions, indicating greater emotional clarity and reduced internal conflict. For example, ambivalence in negative emotional expression declined from 42.20 to 36.40 at post-test, rising slightly to 37.00 at follow-up, yet still demonstrating meaningful improvement relative to baseline. Meanwhile, the control group showed virtually no change, suggesting that the intervention uniquely influenced participants' emotional processing.

The overall ambivalence score further illustrates the consistent therapeutic impact, decreasing from 82.40 in the experimental group at pre-test to 73.27 at post-test and remaining stable at 74.00 during follow-up. These findings indicate that the intervention effectively reduced the psychological tension associated with emotional expression, a common challenge among individuals with chronic neurological conditions. The absence of comparable shifts in the control group underscores the specificity of the intervention's benefits.

Taken together, the observed changes across distress tolerance and ambivalence measures highlight the multidimensional impact of the neuropsychology-based treatment package. Improvements occurred not only in cognitive-emotional resilience but also in participants' ability to evaluate distress, regulate emotional activation, and confidently express their feelings. The maintenance of positive trends over the two-month follow-up period suggests that the skills learned during the intervention were internalized and continued to support participants beyond the structured sessions.

Table 5

Mixed Analysis of Variance (Group × Time) for Distress Tolerance and Emotional Ambivalence

Variable / Subscale	Source	SS	df	MS	F	p	η^2
Distress Tolerance – Total	Time	1587.42	2	793.71	32.84	< .001	.41
	Group	2145.33	1	2145.33	29.56	< .001	.38
	Time × Group	1776.10	2	888.05	36.75	< .001	.43
Ambivalence – Total	Time	1320.57	2	660.29	28.44	< .001	.39
	Group	1480.22	1	1480.22	26.90	< .001	.36
	Time × Group	1205.16	2	602.58	30.77	< .001	.40

The mixed analysis of variance presented in Table 5 indicates statistically significant main effects of time and group, as well as significant interaction effects between time and group for both total distress tolerance and total emotional ambivalence. The significant main effect of time shows that participants in both groups experienced changes across the three measurement points, although the magnitude of change differed markedly between groups. The significant main effect of group indicates that the experimental group had overall higher distress tolerance and lower emotional ambivalence compared with the control group. Most importantly, the Time × Group interaction was significant for both variables, demonstrating that the experimental intervention—unlike standard care—produced meaningful improvements over time. Large effect sizes (η^2 ranging from .36 to .43) confirm that the neuropsychology-based treatment had substantial impact on outcomes compared with the control condition. These results collectively support the effectiveness of the intervention across the study period.

Table 6

Bonferroni Post Hoc Comparisons for Time Points within Each Group

Variable / Subscale	Group	Comparison	Mean Difference (MD)	p (Bonferroni)
Distress Tolerance – Total	Experimental	Pre-test vs. Post-test	11.50	< .001
		Pre-test vs. Follow-up	9.20	< .001
		Post-test vs. Follow-up	–2.30	.112
	Control	Pre-test vs. Post-test	0.60	.742
		Pre-test vs. Follow-up	0.10	.982
		Post-test vs. Follow-up	–0.50	.801

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Ambivalence – Total	Experimental	Pre-test vs. Post-test	–9.13	< .001
		Pre-test vs. Follow-up	–8.40	< .001
		Post-test vs. Follow-up	0.73	.641
	Control	Pre-test vs. Post-test	–0.34	.855
		Pre-test vs. Follow-up	–0.20	.902
		Post-test vs. Follow-up	0.14	.944

The Bonferroni post hoc analysis shown in Table 6 further clarifies the nature of changes over time in both groups. In the experimental group, significant improvements occurred from pre-test to post-test and from pre-test to follow-up for both distress tolerance and emotional ambivalence ($p < .001$). These results indicate that the intervention produced rapid and meaningful gains that were largely maintained over two months. The non-significant difference between post-test and follow-up ($p > .05$) suggests that improvements stabilized rather than diminished, demonstrating intervention durability. In contrast, the control group showed no significant changes between any time points across both variables (all $p > .74$), confirming the absence of natural improvement without targeted intervention. Together, these findings provide strong evidence that the neuropsychology-based therapeutic program was responsible for the observed positive changes, and that its effects persisted after treatment completion.

4. Discussion and Conclusion

The purpose of this study was to develop a neuropsychology-based therapeutic package for individuals with multiple sclerosis (MS) and evaluate its effectiveness in improving distress tolerance and reducing emotional ambivalence. The quantitative findings demonstrated significant increases in all subcomponents of distress tolerance—including tolerance, appraisal, absorption, and emotional regulation—as well as substantial decreases in ambivalence toward emotional expression among participants receiving the neuropsychology-based intervention compared with the control group. These improvements were sustained at the two-month follow-up, indicating the durability of treatment gains. The qualitative phase further supported these outcomes by providing a rich theoretical and experiential basis for the intervention, integrating cognitive rehabilitation, emotional regulation, mindfulness, and self-management skills tailored to MS-related cognitive-emotional vulnerabilities.

The positive effects on distress tolerance align with previous studies showing that MS patients exhibit lower baseline distress tolerance compared with healthy individuals due to cognitive fatigue, emotional reactivity, and neurobiological dysregulation (Azami et al., 2019). The observed post-intervention increases in distress tolerance are consistent with findings that therapeutic approaches targeting cognitive control mechanisms can strengthen regulatory capacity and reduce emotional vulnerability in MS populations (Dennison et al., 2009). The cognitive rehabilitation components of the intervention—including working memory training and attention regulation—likely contributed to these improvements by enhancing executive functioning and cognitive flexibility, both of which are central to tolerating distress and resisting maladaptive avoidance tendencies. This interpretation is supported by research demonstrating that cognitive deficits in MS are strongly associated with affective instability, poorer coping, and lower adaptive resilience (Cuerda-Ballester et al., 2023).

The emotional regulation aspects of the intervention also appear to have played a central role in the observed outcomes. Mindfulness training and cognitive restructuring exercises were associated with reductions in emotional reactivity and increased capacity to engage constructively with negative internal experiences. These findings are in line with prior studies showing that mindfulness-based interventions improve emotional control, reduce catastrophic thinking, and enhance self-compassion in MS patients (Falahichamachar & Razavi, 2023). Moreover, studies indicate that emotion regulation serves as a critical determinant of health outcomes, daily functioning, and disease adaptation among individuals with MS, with better regulatory strategies linked to improved well-being and quality of life (Dehghan et al., 2023). The significant improvements in emotional regulation observed in the current study provide empirical confirmation of these theoretical assertions.

The reduction in emotional ambivalence following the intervention further supports the efficacy of the integrated neuropsychology-based approach. Emotional ambivalence in MS is often associated with disrupted emotional processing networks, impaired social cognition, and heightened alexithymia (Van Assche et al., 2021). Patients may experience conflicting impulses about expressing emotions, fearing social burden or miscommunication, thereby inhibiting healthy emotional exchange. The

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intervention's emphasis on communication skills, emotional expression practice, and cognitive reframing likely facilitated greater clarity and confidence in emotional expression. The results correspond with previous research demonstrating that psychological interventions improve emotional expressiveness and relational functioning in MS, particularly when addressing interpersonal communication and emotional meaning-making (Zeinali Siyavashani & Dehghan, 2021). Reductions in ambivalence observed in this study thus reflect not only symptom improvement but also enhanced social adaptability and interpersonal competence.

Another notable finding was the stability of treatment gains at follow-up. Although some slight reductions in effect size were observed between post-test and follow-up, the improvements remained significantly higher than baseline. This pattern is consistent with prior studies showing that therapeutic gains in MS are often maintained when interventions target both cognitive and emotional domains in a structured, integrated manner (Shareh et al., 2019). The maintenance of progress can also be attributed to the self-management components of the intervention—such as symptom monitoring, pacing strategies, and long-term treatment planning—which empower patients to sustain therapeutic benefits beyond the formal treatment period. This interpretation aligns with evidence showing that self-efficacy and self-regulatory competence predict long-term health outcomes in MS (Dehghan et al., 2023).

The integration of neuropsychological principles within the intervention appears to be particularly advantageous. Prior research suggests that impairments in cognitive domains—including memory, attention, and executive function—can directly influence emotional reactivity and coping behaviors (Brands et al., 2018). By strengthening these domains through targeted cognitive exercises and structured problem-solving, the intervention may have enhanced participants' ability to regulate their emotional responses more effectively. Neuroimaging studies further provide evidence that cognitive rehabilitation can modify neural pathways implicated in emotional regulation, thereby supporting the neuropsychological rationale of the present treatment model (Pfaff et al., 2021). The results thus offer empirical support for developing multimodal interventions that simultaneously address the cognitive and emotional consequences of MS.

The study's findings also align with the literature demonstrating that psychological therapies such as ACT, MBCT, and compassion-based programs improve psychological flexibility, distress tolerance, and emotional functioning in MS populations (Alizadeh et al., 2023; Dizaj Khalili et al., 2023; Moeinzadeh et al., 2025). However, the neuropsychology-based model developed in this study differs in its explicit integration of cognitive rehabilitation with emotion-regulation strategies. This combination appears to yield broader therapeutic benefits, particularly in domains such as appraisal and absorption, which have not been as fully addressed in previous interventions. The current results extend prior findings by demonstrating that integrating cognitive and emotional training within a unified structure produces more robust and comprehensive improvements across multiple psychological dimensions.

The results related to emotional expression and ambivalence also align with theoretical frameworks emphasizing the role of social cognition in MS adaptation. Deficits in emotion recognition and expression have been reported in MS and linked to poorer social functioning, interpersonal strain, and reduced quality of life (Radlak et al., 2021). By targeting emotional clarity, communication skills, and supportive group dynamics, the intervention appears to have enhanced participants' sense of interpersonal efficacy. This outcome is consistent with research suggesting that emotional expression and interpersonal involvement contribute to post-traumatic growth and emotional resilience among individuals with chronic illness (Zeinali Siyavashani & Dehghan, 2021).

Finally, the improvements in distress tolerance observed in this study are consistent with findings showing that emotion regulation difficulties in MS may be linked to both neurobiological and psychosocial factors. Increases in distress tolerance may reflect enhanced cognitive control, reduced catastrophizing, improved mindfulness skills, and increased acceptance—mechanisms supported by ACT, MBCT, and emotion-focused therapies used in prior MS research (Ebrahimi et al., 2022; Nordin & Rorsman, 2011; Shareh et al., 2019). Taken together, the results of this study support the theoretical and empirical value of a neuropsychology-based, integrative therapeutic intervention capable of addressing both cognitive and emotional aspects of MS.

One limitation of this study is the relatively small sample size, which may constrain the generalizability of the findings to broader MS populations with diverse disease stages and symptom profiles. Additionally, although follow-up data demonstrated sustained improvements, the follow-up period was limited to two months, preventing conclusions about long-term effectiveness. Another limitation concerns the reliance on self-report measures, which may be susceptible

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to response bias or fluctuations related to fatigue. The quasi-experimental design also limits causal inference due to potential uncontrolled confounding variables.

Future research should employ larger, more diverse samples and extend follow-up periods to assess long-term maintenance of treatment effects. Studies could also incorporate neuroimaging or neurophysiological markers to evaluate neural changes associated with intervention outcomes. Further research is needed to compare the neuropsychology-based model with established treatments such as ACT or MBCT to determine relative efficacy. Additionally, future studies may explore digital or hybrid delivery formats to increase accessibility for patients with mobility or fatigue challenges.

Clinicians may consider incorporating neuropsychology-based treatment components—such as cognitive rehabilitation, mindfulness, cognitive restructuring, and structured self-management training—into standard therapeutic programs for MS. Rehabilitation centers could integrate interdisciplinary approaches to address cognitive and emotional needs simultaneously. Finally, practitioners should encourage ongoing self-monitoring, emotional expression, and engagement in peer-support networks to reinforce treatment gains and promote sustained psychological resilience.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the interview and participated in the research with informed consent. Ethical approval for this study was obtained from the Islamic Azad University, Najafabad Branch, under the ethics code IR.IAU.KHSH.REC.1403.049.

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