TIBBIYOT
TA'LIMI & INNOVATSIYALARI



- 14.00.00 - Tibbiyot fanlari;
- 14.00.01 - Akusherlik va ginekologiya;
- 14.00.02 - Morfologiya;
- 14.00.03 - Endokrinologiya;
- 14.00.04 - Otorinolaringologiya;
- 14.00.05 - Ichki kasalliklar;
- 14.00.06 - Kardiologiya;
- 14.00.07 - Gigiena;
- 14.00.08 - Oftal'mologiya;
- 14.00.09 - Pediatriya;
- 14.00.10 - Yuqumli kasalliklar;
- 14.00.11 - Dermatologiya va venerologiya;
- 14.00.12 - Tibbiy reabilitologiya;
- 14.00.13 - Nevrologiya;
- 14.00.14 - Onkologiya;
- 14.00.15 - Patologik anatomiya;
- 14.00.16 - Normal va patologik fiziologiya;
- 14.00.17 - Farmakologiya va klinik farmakologiya;
- 14.00.18 - Psixiatriya va narkologiya;
- 14.00.19 - Klinik radiologiya;
- 14.00.20 - Tibbiy genetika;
- 14.00.21 - Stomatologiya;
- 14.00.22 - Travmatologiya va ortopediya;
- 14.00.23 - Hamshiralik ishini tashkil etish;
- 14.00.24 - Sud tibbiyoti;
- 14.00.27 - Xirurgiya;
- 14.00.28 - Neyroxirurgiya;
- 14.00.41 - Xalq tabobati;
- 14.00.35 - Bolalar xirurgiyasi;
- 14.00.34 - Yurak-qon tomir xirurgiyasi

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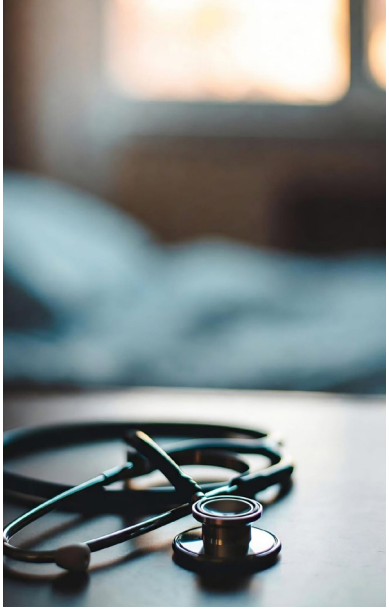
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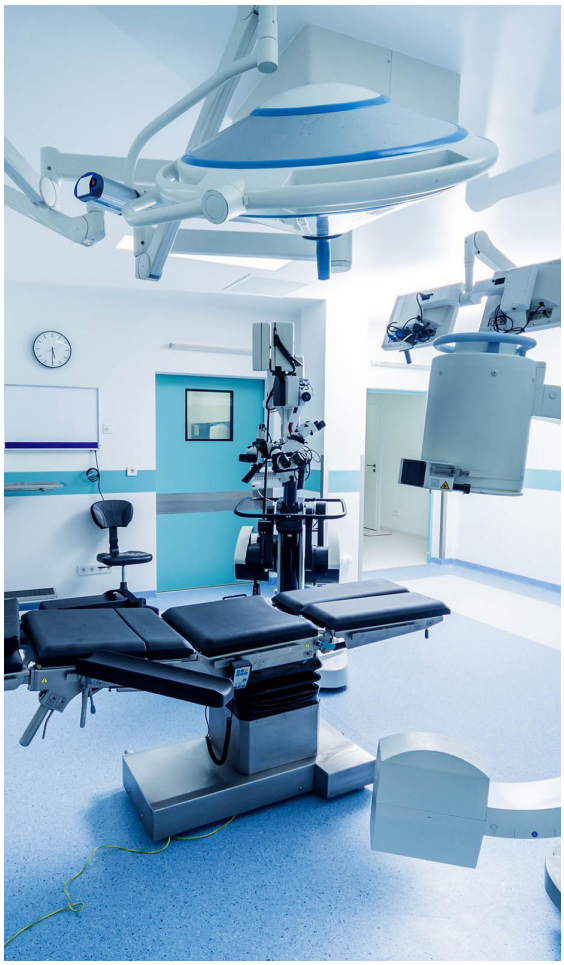
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“Tibbiyot ta'limi va innovasiyalari” ilmi elektron jurnali 29.04.2025-yildan O‘zbekiston Respublikasi Prezidenti Adminstratsiyasi huzuridagi Axborot va ommaviy kommunikatsiyalar agentligi tomonidan C-5669801 reyestr raqami tartibi bo‘yicha ro‘yxatdan o‘tkazilgan. Litsenziya raqami: №745444.

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MUNDARIJA

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MULTIDIMENSIONAL EFFECTS OF PSYCHOMOTOR REHABILITATION AFTER ISCHEMIC STROKE: A CONTROLLED STUDY OF MOTOR, FUNCTIONAL, BALANCE, AND EMOTIONAL RECOVERY

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Abstract: This study investigated the effectiveness of psychomotor therapy in the rehabilitation of patients after ischemic stroke. The study included 100 patients with ischemic stroke who were divided into two groups receiving either standard rehabilitation or standard rehabilitation combined with psychomotor therapy. Over an eight-week period, functional independence, motor function, balance, and psychoemotional status were assessed using the Barthel Index, Fugl-Meyer Assessment, Berg Balance Scale, and Hospital Anxiety and Depression Scale. The results demonstrated greater improvements in functional independence, upper- and lower-limb motor function, balance, and postural control, as well as greater reductions in anxiety and depressive symptoms among patients receiving additional psychomotor therapy. The findings indicate that psychomotor therapy may be incorporated as a complementary component of comprehensive post-stroke rehabilitation programs.

Key words: ischemic stroke; psychomotor therapy; neurorehabilitation; motor recovery; functional independence; balance; postural control; anxiety; depression; rehabilitation.

Annotatsiya: Ushbu maqolada ishemik insultdan keyingi bemorlarni reabilitatsiya qilishda psixomotor terapiyaning samaradorligi o‘rganilgan. Tadqiqotda 100 nafar ishemik insultga chalingan bemor ikki guruhga ajratilib, ularga standart reabilitatsiya hamda standart reabilitatsiyaga qo‘shimcha psixomotor terapiya qo‘llanilgan. Sakkiz hafta davomida bemorlarning funksional mustaqilligi, motor faoliyati, muvozanat va psixoemotsional holati Barthel indeksi, Fugl-Meyer baholash shkalasi, Berg muvozanat shkalasi hamda HADS yordamida baholangan. Natijalar psixomotor terapiya qo‘shilgan guruhda kundalik faoliyatdagi mustaqillik, yuqori va pastki ekstremitalar motor funksiyasi, muvozanat, xavotir va depressiv simptomlarda sezilarli ijobiy o‘zgarishlar kuzatilganini ko‘rsatdi. Tadqiqot natijalari psixomotor terapiyani insultdan keyingi kompleks reabilitatsiya dasturining qo‘shimcha tarkibiy qismi sifatida qo‘llash mumkinligini ko‘rsatadi.

Kalit so‘zlar: ishemik insult; psixomotor terapiya; neyroreabilitatsiya; motor tiklanish; funksional mustaqillik; muvozanat; postural nazorat; xavotir; depressiya; reabilitatsiya.

Аннотация: В статье изучена эффективность психомоторной терапии в реабилитации пациентов после ишемического инсульта. В исследование были включены 100 пациентов с ишемическим инсультом, распределённых на две группы: стандартной реабилитации и стандартной реабилитации в сочетании с психомоторной терапией. В течение восьми недель оценивались функциональная независимость, двигательная функция, равновесие и психоэмоциональное состояние пациентов с использованием индекса Бартел, шкалы оценки Фугля–Мейера, шкалы равновесия Берга и госпитальной шкалы тревоги и депрессии. Полученные результаты показали более выраженное улучшение функциональной независимости, двигательной функции верхних и нижних конечностей, равновесия, а также снижение симптомов тревоги и депрессии у пациентов, получавших дополнительную психомоторную терапию. Результаты исследования свидетельствуют о возможности включения психомоторной терапии в комплексные программы постинсультной реабилитации.

Ключевые слова: ишемический инсульт; психомоторная терапия; нейрореабилитация; двигательное восстановление; функциональная независимость; равновесие; постуральный контроль; тревога; депрессия; реабилитация.

INTRODUCTION

Stroke remains a major cause of mortality and long-term disability worldwide, with many survivors experiencing persistent motor deficits, impaired balance, reduced functional independence, and psychoemotional disturbances [3,7]. These complications substantially limit activities of daily living and may adversely affect participation in rehabilitation and overall recovery [1,6,9]. Consequently, improving multidimensional recovery after ischemic stroke remains an important challenge in contemporary neurorehabilitation. The complex interaction between motor, sensory, postural, and emotional impairments highlights the need for rehabilitation strategies that address several domains simultaneously. Therefore, integrative approaches capable of improving both physical function and psychoemotional well-being are of particular clinical interest.

LITERATURE REVIEW

Evidence from stroke rehabilitation research supports repetitive motor practice, task-oriented training, balance exercises, and sensory-motor stimulation as important components of functional recovery [9,11,12]. Experience-dependent training may facilitate neuroplastic reorganization after brain injury, providing a neurophysiological basis for intensive and structured rehabilitation interventions [5]. Motor control approaches further emphasize the interaction between movement, sensory feedback, postural control, and task performance [10]. At the same time, post-stroke depression and anxiety may negatively influence motivation and rehabilitation outcomes, indicating that recovery should not be assessed solely through motor performance [1]. Validated instruments such as the Fugl-Meyer Assessment, Barthel Index, Berg Balance Scale, and Hospital Anxiety and Depression Scale allow evaluation of motor function, functional independence, balance, and emotional status [2,4,8,13].

Although the benefits of conventional physical and task-oriented rehabilitation are well established, the combined multidimensional effects of psychomotor rehabilitation on motor recovery, functional independence, balance, and emotional status remain insufficiently investigated. This gap provided the rationale for the present study. Therefore, the aim of this study was to evaluate the effectiveness of psychomotor therapy as an adjunct to standard rehabilitation in patients after ischemic stroke using a multidimensional assessment of motor, functional, balance, and psychoemotional recovery.

RESEARCH METHODOLOGY

This study was designed as a prospective controlled clinical study aimed at evaluating the effectiveness of psychomotor rehabilitation in patients after ischemic stroke. The research was conducted in cooperation with the neurology department and specialized rehabilitation centers in Tashkent, Uzbekistan. All procedures were performed in accordance with international ethical standards for biomedical research involving human participants. Participation in the study was voluntary, and all participants provided written informed consent before inclusion. Patients received standard neurorehabilitation therapy according to clinical practice guidelines. In addition, patients in the intervention group underwent structured psychomotor rehabilitation sessions conducted by trained rehabilitation specialists.

Participants. A total of 130 individuals were initially screened for participation in the study. Among them, 100 patients with ischemic stroke met the inclusion criteria and were included in the final statistical analysis, while 30 healthy individuals were recruited as a control group for baseline comparison. Patients with ischemic stroke were randomly assigned to two groups using a simple randomization method (Table 1).

Table 1. Distribution of participants across study groups

Group	Number of participants
Psychomotor therapy combined with standard	50
Standard rehabilitation	50
Healthy control	30
Total	130

Participant inclusion and exclusion were determined according to the following predefined criteria (Table 2.)

Table 2. Inclusion and exclusion criteria for participant selection

Inclusion criteria	Exclusion criteria
confirmed diagnosis of ischemic stroke	recurrent stroke
age 30–70 years	severe somatic or psychiatric disorders
post-stroke rehabilitation stage	severe cognitive impairment
NIHSS score 5–20	epilepsy or uncontrolled cardiovascular disease
preserved cognitive ability	inability to participate regularly
stable neurological condition	absence during final evaluation
written informed consent	-

After applying these criteria, 100 patients were included in the final analysis. The diagnosis of ischemic stroke was confirmed using magnetic resonance imaging (MRI) and computed tomography (CT). MRI examinations included DWI, FLAIR, T1-weighted, and T2-weighted sequences to identify ischemic lesions. Additional diagnostic procedures included Doppler ultrasonography of the brachiocephalic arteries, electrocardiography (ECG), and echocardiography (EchoCG). These examinations were carried out to further clarify the etiology of ischemic stroke and to identify possible comorbid cardiovascular conditions that could influence the clinical course of the disease and the rehabilitation process. Stroke localization was classified according to vascular territory using MRI findings (Table 3, Figure 1).

Table 3. Distribution of ischemic stroke localization

Localization	Psychomotor group (n=50)	Control group (n=50)
Left hemisphere (ACA + MCA)	11 (22%)	13 (26%)
Right MCA territory	17 (34%)	18 (36%)
Vertebrobasilar territory	22 (44%)	19 (38%)

No statistically significant differences between groups were observed at baseline ($p > 0.05$).

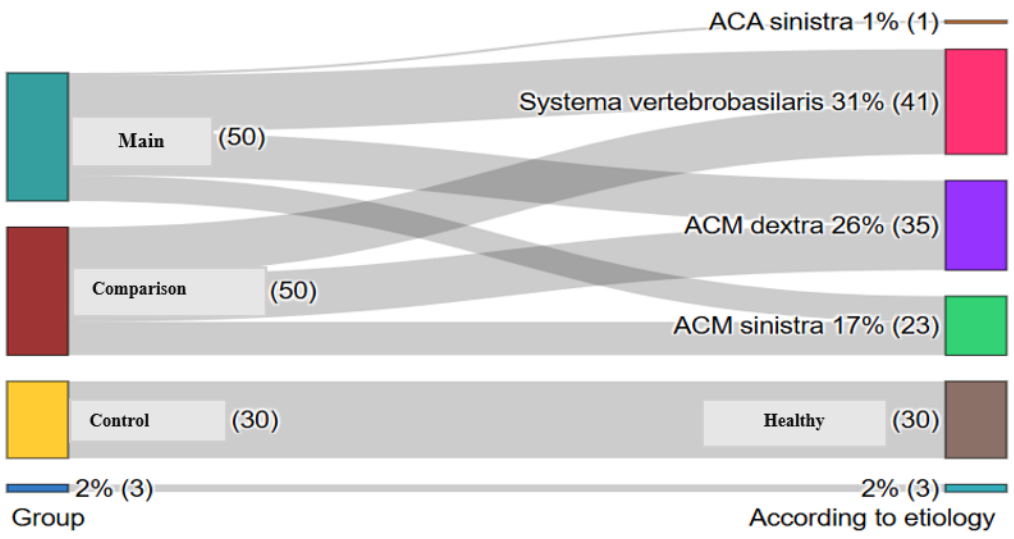


Figure 1. Distribution of stroke localization by vascular territory

Rehabilitation protocol. All participants received standard rehabilitation therapy, including therapeutic exercises and functional training. Patients in the intervention group additionally underwent psychomotor rehabilitation sessions consisting of: sensorimotor integration exercises, coordination training, rhythmic motor exercises, task-oriented movement training, body awareness exercises. The rehabilitation program lasted 8 weeks, with four sessions per week, each session lasting 60 minutes (Table 4).

Table 4. Psychomotor rehabilitation protocol

Parameter	Value
Session duration	60 minutes
Sessions per week	4
Program duration	8 weeks
Total sessions	32

Warm-up (10 min). Sensorimotor exercises (15 min). Coordination and balance training (15 min). Task-oriented motor exercises (15 min). Relaxation and body awareness (5 min). Functional Outcome Measures. To comprehensively evaluate the effectiveness of the rehabilitation program, functional and psychoemotional outcomes were assessed using standardized and widely validated clinical scales. These instruments were selected to capture multiple domains of recovery, including functional independence, motor performance, balance, and emotional status. Functional independence in daily activities was assessed using the Barthel Index (BI), a widely applied instrument for evaluating the level of independence in patients with neurological disorders, particularly after stroke. The scale measures the patient's ability to perform essential activities of daily living, including feeding, bathing, dressing, toileting, transfers, mobility, and continence. The total score ranges from 0 to 100 points, with higher scores indicating greater functional independence and a lower degree of disability. Due to its high reliability, validity, and sensitivity to clinical change, the Barthel Index is widely used to monitor functional recovery during post-stroke rehabilitation. Motor and sensory recovery were evaluated using the Fugl-Meyer Assessment (FMA), which is considered one of the most comprehensive and validated tools for assessing motor function in stroke patients. The scale examines several domains of neurological recovery, including upper limb motor function, lower limb motor function, sensory function, joint range of motion, and pain. Each domain is scored according to standardized criteria, allowing a detailed evaluation of motor impairment and recovery dynamics. The FMA is a well-validated instrument for assessing motor recovery after stroke because of its strong psychometric properties and its ability to detect clinically meaningful changes in motor performance during rehabilitation.

Balance and postural stability were evaluated using the Berg Balance Scale (BBS), one of the most frequently used clinical instruments for assessing balance performance in individuals with neurological disorders. The BBS consists of 14 functional tasks that evaluate both static and dynamic balance abilities, including sitting balance, standing, transfers, reaching, turning, and single-leg stance. Each item is scored on a five-point scale (0–4), resulting in a maximum total score of 56 points. Higher scores reflect better postural control and a lower risk of falls. The BBS has demonstrated high reliability and validity in stroke populations and is widely used to monitor changes in balance during rehabilitation. Emotional status was assessed using the Hospital Anxiety and Depression Scale (HADS), a widely used screening instrument designed to evaluate psychological distress in patients with medical conditions. The scale includes two subscales assessing anxiety (HADS-A) and depression (HADS-D), each consisting of seven items scored from 0 to 3, with subscale scores ranging from 0 to 21 points. Higher scores indicate greater severity of anxiety or depressive symptoms. The HADS is particularly useful in neurological and rehabilitation settings because it minimizes the influence of somatic symptoms that may overlap with physical illness. The combined use of the Barthel Index, Fugl-Meyer Assessment, Berg Balance Scale, and Hospital Anxiety and Depression Scale provides a multidimensional evaluation of post-stroke recovery. These instruments assess key domains of rehabilitation outcomes, including functional independence in daily activities, motor and sensory recovery, balance and postural stability, and emotional well-being. Together, they allow a comprehensive assessment of the effectiveness of rehabilitation interventions and are widely recommended in both clinical practice and stroke rehabilitation research. All outcome measures were administered twice: at baseline (before the start of rehabilitation) and after completion of the 8-week intervention period. This allowed for the assessment of both within-group changes and between-group differences over time.

Statistical Analysis. Statistical analysis was performed in accordance with the study design, with a significance level set at $p < 0.05$. Descriptive statistics were used to summarize baseline characteristics, with continuous variables expressed as mean ± standard deviation, and categorical variables as frequencies and percentages. Due to the ordinal nature of clinical scales and potential non-normal distribution, baseline comparisons between the psychomotor therapy and standard rehabilitation groups were conducted using the Mann-Whitney U test. Categorical variables were analyzed using the chi-square test. To evaluate changes over time and differences between groups, a two-way mixed-design ANOVA was applied, with time (pre- and post-intervention) as a within-subject factor and group (psychomotor therapy vs. standard rehabilitation)

as a between-subject factor. The primary focus was on the interaction effect (time × group), reflecting the effectiveness of the intervention. Effect sizes were calculated using partial eta squared ($\eta^2 p$) to assess the magnitude of observed effects. All analyses were performed using standard statistical software.

ANALYSIS AND RESULTS

Baseline comparability of the study groups. Baseline comparability between the intervention and control groups was assessed to ensure the internal validity of the study design. Since several clinical variables were not normally distributed, the non-parametric Mann-Whitney U test ($\alpha = 0.05$) was used to compare the initial values between groups. The analysis demonstrated no statistically significant differences between the groups at baseline for any of the evaluated clinical variables, including the Barthel Index (BI), Fugl-Meyer Assessment (FMA) subdomains, Berg Balance Scale (BBS), and Hospital Anxiety and Depression Scale (HADS) subscales ($p > 0.05$). These findings indicate that the intervention and control groups were clinically and functionally comparable prior to the initiation of rehabilitation, which allows subsequent differences to be attributed to the applied rehabilitation intervention rather than pre-existing disparities. In contrast, the healthy reference group demonstrated higher functional scores and lower psychoemotional symptom levels across all scales, reflecting the expected profile of a neurologically intact population (Figure 2, Table 5).

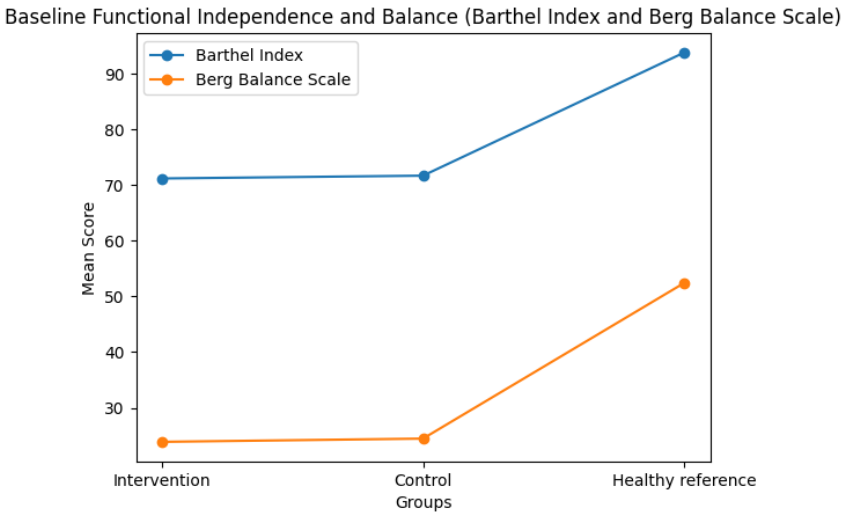


Figure 2. Baseline characteristics of the intervention and control groups according to functional and psychoemotional assessment scales.

Table 5. Baseline comparison of functional independence and balance across study groups (Barthel Index and Berg Balance Scale)

Scale	Intervention group	Control group	Healthy reference
Barthel Index	71.2	71.7	93.8
Balance Scale	23.88	24.46	52.4

Functional independence outcomes based on the Barthel Index. At the beginning of the rehabilitation program, the level of functional independence was comparable between the intervention and control groups. The mean Barthel Index score was 71.2 points in the intervention group and 71.7 points in the control group, with no statistically significant difference between the groups ($p = 0.844$). Following the 8-week rehabilitation program, improvements in functional independence were observed in both groups; however, the magnitude of improvement differed substantially. In the intervention group, the Barthel Index increased from 71.2 to 91.2 points, representing an average improvement of +20.0 points. In contrast, the control group demonstrated a more modest improvement from 71.7 to 77.5 points, corresponding to an average increase of +5.8 points (Figure 3).

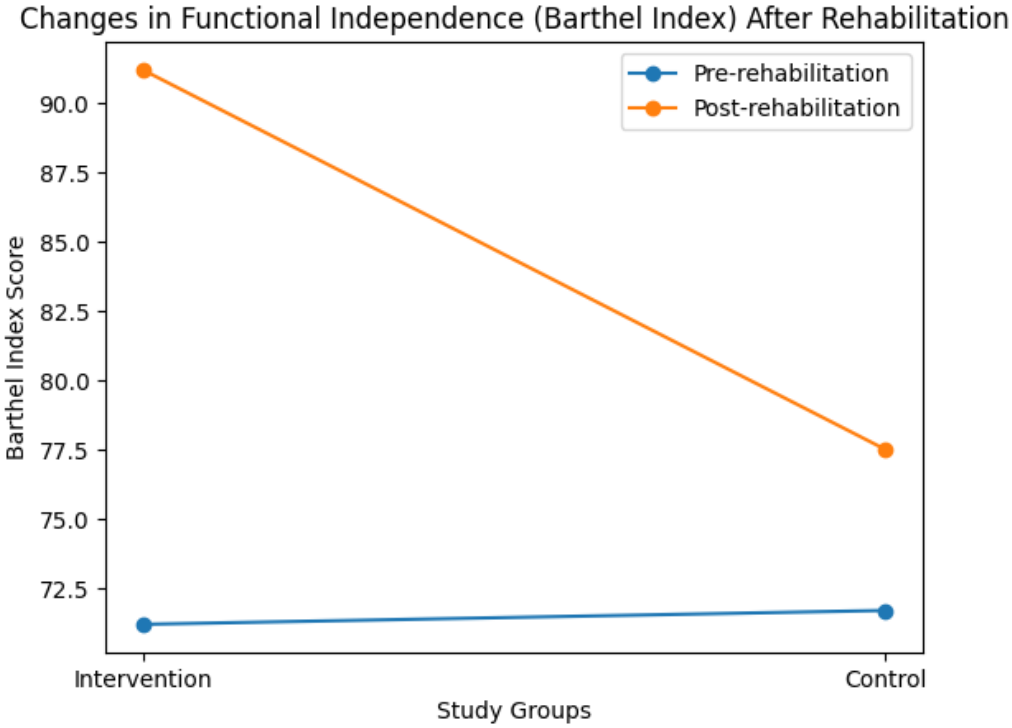


Figure 3. Changes in Barthel Index scores over time in the intervention and control groups.

To further examine the effects of rehabilitation, a 2×2 mixed-design analysis of variance (ANOVA) was conducted, with time as the within-subject factor and group (intervention vs. control) as the between-subject factor. The results demonstrated a significant main effect of time ($F(1,98) = 365$, $p < 0.001$, $\eta^2p = 0.79$), indicating a substantial overall improvement in functional independence during the rehabilitation period. The group effect was also statistically significant ($F(1,98) = 27.67$, $p < 0.001$, $\eta^2p = 0.22$), suggesting that functional outcomes differed between the intervention and control groups. Importantly, the time × group interaction effect was highly significant ($F(1,98) = 110.57$, $p < 0.001$, $\eta^2p = 0.53$), indicating that the rate of functional recovery was significantly greater in the intervention group compared with the control group. Across the entire sample, the mean Barthel Index score increased from 71.45 to 84.35 points, indicating an overall improvement in functional independence during the rehabilitation period (Table 6).

Table 6. Mixed-design ANOVA results for the Barthel Index according to time and group factors.

Factor	Sum of Squares	df	Mean Square	F	p	η^2	η^2p
BI (Pre vs Post)	8320.5	1	8320.5	365	<.001	0.36	0.79
Group	2178	1	2178	27.67	<.001	0.09	0.22
Time × Group	2520.5	1	2520.5	110.57	<.001	0.11	0.53
Residuals (Between)	7715	98	78.72				
Residuals (Within)	2234	98	22.8				

From a clinical perspective, the increase in the Barthel Index to above 90 points in the intervention group indicates that most patients regained a high level of independence in daily activities. Although improvement was also observed in the control group, a certain degree of functional limitation remained. Motor recovery following rehabilitation was evaluated using the upper- and lower-limb motor components of the Fugl-Meyer Assessment (FMA). At baseline, the psychomotor rehabilitation and comparison groups demonstrated comparable levels of motor impairment. The mean upper-limb FMA scores were 33.56 points in the psychomotor rehabilitation group and 32.18 points in the comparison group, while the corresponding lower-limb scores were 23.26 and

22.82 points, respectively. These findings indicated that the groups were comparable in terms of baseline motor function before the rehabilitation intervention. Upper-limb motor recovery was substantially greater in the psychomotor rehabilitation group. The mean FMA upper-limb score increased from 33.56 to 49.28 points, corresponding to an improvement of +15.72 points. In the comparison group, the score increased from 32.18 to 37.44 points, representing an improvement of +5.26 points. Repeated-measures analysis demonstrated a highly significant main effect of time ($F(1,98) = 582.38$, $p < 0.001$, $\eta^2p = 0.86$), indicating considerable upper-limb motor recovery during rehabilitation. The group effect was also significant ($F(1,98) = 35.74$, $p < 0.001$, $\eta^2p = 0.27$). Importantly, the time × group interaction was highly significant ($F(1,98) = 144.76$, $p < 0.001$, $\eta^2p = 0.60$), demonstrating that improvement in upper-limb motor function was significantly greater in the psychomotor rehabilitation group (Figure 4).

A similar pattern was observed for lower-limb motor recovery. In the psychomotor rehabilitation group, the FMA lower-limb score increased from 23.26 to 30.78 points, corresponding to an improvement of +7.52 points. In the comparison group, the score increased from 22.82 to 25.84 points, representing an improvement of +3.02 points. The main effect of time was highly significant ($F(1,98) = 248.00$, $p < 0.001$, $\eta^2p = 0.72$), confirming substantial improvement in lower-limb motor function during rehabilitation. The group effect was also statistically significant ($F(1,98) = 9.67$, $p = 0.002$, $\eta^2p = 0.09$). Most importantly, the time × group interaction was significant ($F(1,98) = 45.21$, $p < 0.001$, $\eta^2p = 0.32$), indicating that lower-limb motor recovery was significantly greater in patients who received psychomotor therapy in addition to standard rehabilitation (Table 7). The Fugl-Meyer Assessment demonstrated significant motor improvement in both groups over the rehabilitation period. However, the significant time × group interactions for both upper- and lower-limb motor function indicate that the addition of psychomotor therapy to standard rehabilitation produced greater motor recovery than standard rehabilitation alone. The magnitude of the interaction effect was particularly pronounced for upper-limb motor recovery ($\eta^2p = 0.60$), while a substantial additional effect was also observed for lower-limb motor recovery ($\eta^2p = 0.32$).

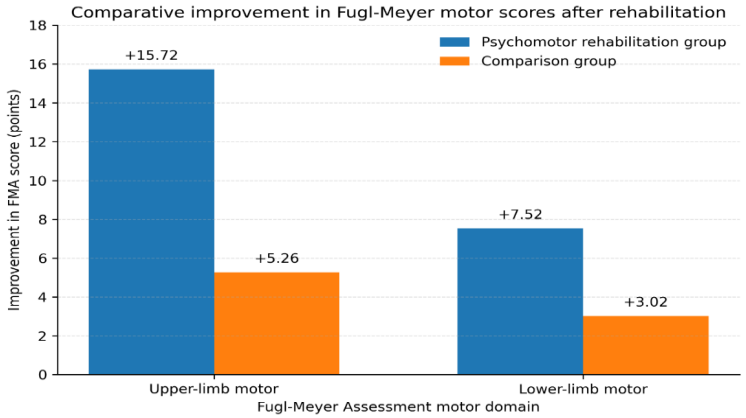


Figure 4. Comparative improvement in upper- and lower-limb Fugl-Meyer motor scores after rehabilitation in the psychomotor and comparison groups

Table 7. Changes in Fugl-Meyer Assessment motor components after rehabilitation

FMA domain	Psychomotor group (Before and After)	Improvement	Comparison group (Before and After)	Improvement	Time × Group F	p	η^2p
Upper-limb motor	33.56 → 49.28	+15.72	32.18 → 37.44	+5.26	144.76	<0.001	0.60
Lower-limb motor	23.26 → 30.78	+7.52	22.82 → 25.84	+3.02	45.21	<0.001	0.32

At baseline, the Berg Balance Scale (BBS) scores indicated comparable levels of balance impairment between groups. The mean BBS score was 23.88 in the intervention group and 24.46 in the control group, suggesting moderate to severe balance impairment in both groups. Across the entire sample, the baseline mean BBS value was 24.17, confirming substantial limitations in postural stability among the participants prior to rehabilitation. Following the rehabilitation program, significant improvements were observed. The mean BBS

score increased to 43.7 in the intervention group, while the control group reached 30.9 points. The overall post-rehabilitation mean score across the entire sample was 37.3, reflecting a general improvement in balance function. The mean balance scores during the study period were 33.79 in the intervention group and 27.68 in the control group, indicating a greater recovery of postural stability in the intervention group (Figure 5).

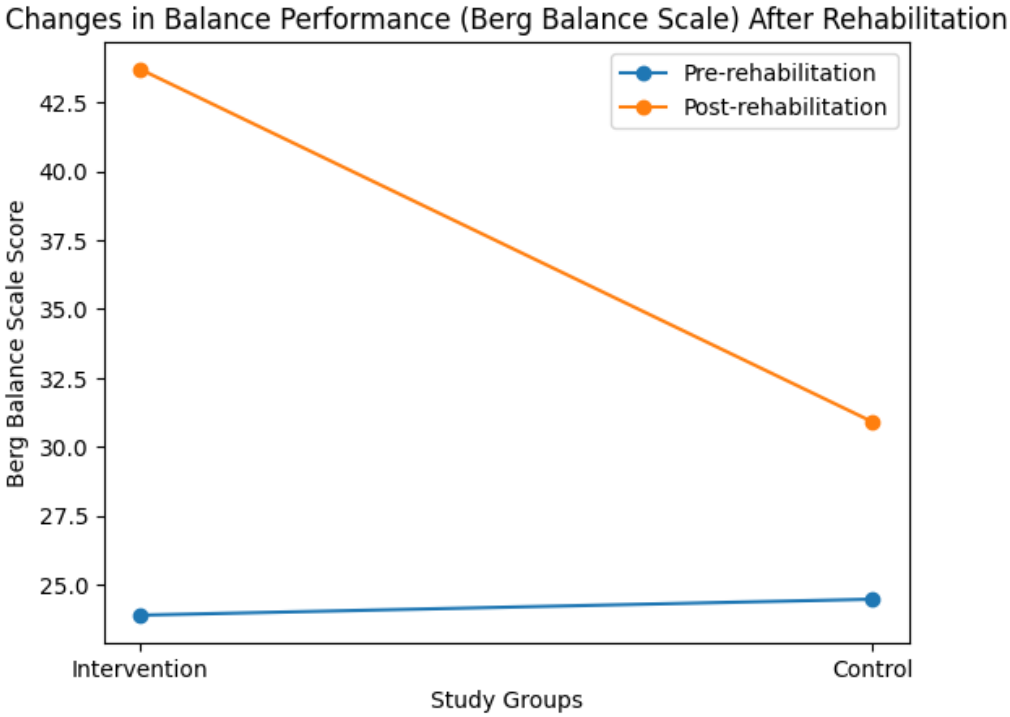


Figure 5. Dynamics of Berg Balance Scale scores in the intervention and control groups over the rehabilitation period.

A 2×2 mixed-design ANOVA was performed to analyze the effects of time and group on balance performance. The results revealed a significant main effect of time ($F(1,98) = 597.9$, $p < 0.001$, $\eta^2p = 0.86$), indicating a substantial improvement in balance function during the rehabilitation period. The group effect was also statistically significant ($F(1,98) = 157.17$, $p < 0.001$, $\eta^2p = 0.62$), suggesting differences in balance outcomes between the intervention and control groups. Furthermore, the time × group interaction effect was highly significant ($F(1,98) = 155.22$, $p < 0.001$, $\eta^2p = 0.61$), indicating that the improvement in balance and postural control was significantly greater in the intervention group (Table 8).

Table 8. Mixed-design ANOVA results for the Berg Balance Scale according to time and group factors.

Factor	Sum of Squares	df	Mean Square	F	p	η^2	η^2p
BBS (Pre vs Post)	8619.84	1	8619.84	597.9	<.001	0.56	0.86
Group	1866.6	1	1866.6	157.17	<.001	0.12	0.62
Time × Group	2237.8	1	2237.8	155.22	<.001	0.15	0.61
Residuals (Between)	1163.85	98	11.88				
Residuals (Within)	1412.85	98	14.42				

The dynamics of psychoemotional status were assessed using the anxiety (HADS-A) and depression (HADS-D) subscales of the Hospital Anxiety and Depression Scale. At baseline, anxiety levels were identical in both groups, with a mean score of 12.1, indicating a comparable initial psychoemotional state (Figure 6). Following the rehabilitation program, anxiety scores decreased in both groups; however, the magnitude of

improvement differed substantially. In the psychomotor therapy group, anxiety levels decreased from 12.1 to 4.9, reflecting a marked clinical reduction in symptoms. In contrast, the control group showed a more modest decrease from 12.1 to 9.94, suggesting partial persistence of anxiety symptoms. The overall sample demonstrated a reduction from 12.1 to 7.42.

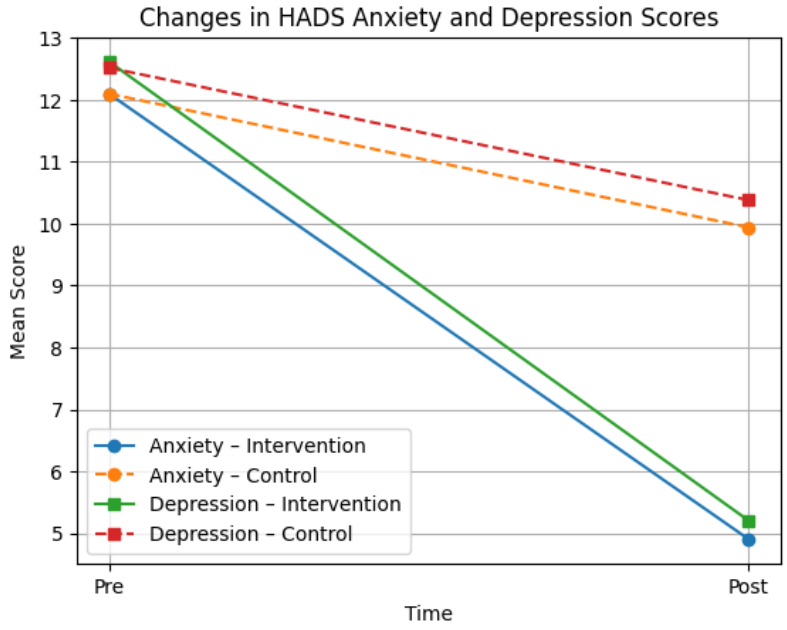


Figure 6. Changes in HADS scores over time in the intervention and control groups

To further examine these changes, a mixed-design ANOVA was conducted. The results revealed a highly significant main effect of time ($F(1,98) = 543.79$, $p < 0.001$, $\eta^2p = 0.85$), indicating a substantial overall reduction in anxiety levels. A significant group effect was also observed ($F(1,98) = 64.16$, $p < 0.001$, $\eta^2p = 0.40$), suggesting differences between the intervention and control groups. Importantly, the time × group interaction was highly significant ($F(1,98) = 157.67$, $p < 0.001$, $\eta^2p = 0.62$), confirming that the reduction in anxiety was significantly greater in the psychomotor therapy group (Table 9).

Table 9. Mixed-design ANOVA results for HADS-A

Source of Variation	Sum of Squares	df	Mean Square	F	p-value	η^2	η^2p
Time (pre vs post)	1095.12	1	1095.12	543.79	<0.001	0.45	0.85
Group	317.52	1	317.52	64.16	<0.001	0.13	0.40
Time × Group	317.52	1	317.52	157.67	<0.001	0.13	0.62
Error (between subjects)	484.96	98	4.95	—	—	—	—
Error (within subjects)	197.36	98	2.01	—	—	—	—

A similar pattern was observed for depressive symptoms. At baseline, depression scores were comparable between the groups (12.62 in the intervention group vs. 12.52 in the control group). After rehabilitation, the intervention group demonstrated a pronounced decrease to 5.2, while the control group showed a smaller reduction to 10.38. The overall sample decreased from 12.57 to 7.79 (Figure 6). Mixed ANOVA results confirmed a significant main effect of time ($F(1,98) = 366.95$, $p < 0.001$, $\eta^2p = 0.79$), as well as a significant group effect ($F(1,98) = 24.72$, $p < 0.001$, $\eta^2p = 0.20$). The interaction effect was also statistically significant ($F(1,98) = 111.93$, $p < 0.001$, $\eta^2p = 0.53$), indicating that depressive symptoms decreased more substantially in the psychomotor therapy group (Table 10).

Table 10. Mixed-design ANOVA results for HADS-D

Source of Variation	Sum of Squares	df	Mean Square	F	p-value	η^2	η^2p
Time (pre vs post)	1142.42	1	1142.42	366.95	<0.001	0.34	0.79
Group	322.58	1	322.58	24.72	<0.001	0.09	0.20
Time × Group	348.48	1	348.48	111.93	<0.001	0.10	0.53
Error (between subjects)	1278.94	98	13.05	—	—	—	—
Error (within subjects)	305.10	98	3.11	—	—	—	—

The present study evaluated the effectiveness of psychomotor therapy as an adjunct to standard rehabilitation in patients after ischemic stroke using a multidimensional assessment framework that included the Barthel Index, upper- and lower-limb components of the Fugl-Meyer Assessment, the Berg Balance Scale, and the Hospital Anxiety and Depression Scale. The findings demonstrated significant improvements in functional independence, motor recovery, balance, and psychoemotional status in both groups during the rehabilitation period. However, the magnitude of improvement was consistently greater in the group receiving psychomotor therapy in addition to standard rehabilitation, as demonstrated by significant time × group interactions across all major clinical outcomes. Functional independence, assessed using the Barthel Index, improved substantially in the psychomotor therapy group. The mean score increased by 20.0 points, compared with an improvement of 5.8 points in the comparison group. The significant time × group interaction indicated that the addition of psychomotor therapy was associated with greater recovery of independence in activities of daily living. This finding suggests that rehabilitation combining motor practice, task-oriented activities, postural control, proprioceptive stimulation, and body-awareness components may facilitate the translation of motor recovery into improved everyday functional performance.

Motor recovery assessed by the Fugl-Meyer Assessment showed a clear additional benefit of psychomotor therapy for both upper- and lower-limb function. Upper-limb motor scores improved by 15.72 points in the psychomotor therapy group compared with 5.26 points in the comparison group. The time × group interaction was highly significant, with a large effect size ($\eta^2p = 0.60$), indicating substantially greater upper-limb motor recovery in patients receiving psychomotor therapy. Lower-limb motor function also improved to a greater extent in the psychomotor therapy group, with gains of 7.52 points compared with 3.02 points in the comparison group, and a significant time × group interaction ($\eta^2p = 0.32$). These findings demonstrate that the additional effect of psychomotor therapy was present in both upper- and lower-limb motor recovery, with the effect being particularly pronounced for upper-limb function. Balance and postural control represented another domain in which a pronounced additional effect of psychomotor therapy was observed. Berg Balance Scale scores improved by 19.82 points in the psychomotor therapy group compared with 6.44 points in the comparison group. The significant time × group interaction ($\eta^2p = 0.61$) indicates that the improvement in postural stability was considerably greater when psychomotor therapy was added to standard rehabilitation. The integration of balance exercises, weight-shifting activities, rhythmic movement, proprioceptive facilitation, and task-oriented training may contribute to improved postural control and functional stability.

Psychomotor therapy was also associated with greater improvement in psychoemotional outcomes. Anxiety scores decreased by 7.20 points in the psychomotor therapy group compared with 2.16 points in the comparison group, while depressive symptoms decreased by 7.42 and 2.14 points, respectively. The significant time × group interactions for both HADS-A and HADS-D indicate that the reduction in anxiety and depressive symptoms was greater in patients receiving psychomotor therapy. These findings support the concept that rehabilitation approaches incorporating movement, body awareness, relaxation, and active patient participation may contribute not only to physical recovery but also to psychoemotional improvement during post-stroke rehabilitation. Taken together, the findings demonstrate that the addition of psychomotor therapy to standard rehabilitation produced significant additional benefits across several clinically important domains. The strongest interaction effects were observed for balance, anxiety, upper-limb motor function, depression, and functional independence, while a significant additional effect was also demonstrated for lower-limb motor recovery. Thus, the therapeutic effect of psychomotor rehabilitation should be considered multidimensional, encompassing motor recovery, postural control, functional independence, and psychoemotional status rather than being limited to a single functional domain. These findings support the integration of psychomotor therapy into comprehensive post-stroke rehabilitation programs. Nevertheless, the present results should be interpreted within the context of the study design and sample size. Further multicenter studies involving larger patient populations and longer follow-up periods are required to confirm the persistence of these effects and to further clarify the mechanisms through which psychomotor therapy contributes to post-stroke recovery.

CONCLUSION

The findings of this study demonstrate that the addition of psychomotor therapy to standard rehabilitation was associated with significantly greater improvements in functional independence, upper- and lower-limb motor function, balance and postural control, and psychoemotional status in patients after ischemic stroke. Patients receiving psychomotor therapy demonstrated a greater increase in Barthel Index scores, indicating improved independence in activities of daily living. Fugl-Meyer Assessment results showed significantly greater recovery of both upper- and lower-limb motor function, with the most pronounced additional effect observed in upper-limb motor recovery. These findings indicate that psychomotor therapy may provide an important additional contribution to motor restoration when incorporated into a conventional post-stroke rehabilitation program.

A substantial additional improvement was also observed in balance and postural control, as reflected by the greater increase in Berg Balance Scale scores in the psychomotor therapy group. At the same time, significant reductions in anxiety and depressive symptoms demonstrated that the benefits of psychomotor therapy extended beyond physical recovery to the psychoemotional domain. Overall, the results indicate that psychomotor therapy provides a multidimensional complementary effect in post-stroke rehabilitation by simultaneously supporting motor recovery, functional independence, postural stability, and psychoemotional status.

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