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Effectiveness of Task Oriented Physiotherapy in Improving Functional Mobility Among Patients with Incomplete Spinal Cord Injury: A Randomized Controlled Trial

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ABSTRACT

Background: *Incomplete spinal cord injury (iSCI) frequently results in persistent deficits in gait, balance, and mobility despite preserved motor pathways, necessitating rehabilitation strategies that optimize neuroplasticity and functional recovery. Conventional physiotherapy primarily targets impairment-level strengthening, whereas task-oriented physiotherapy emphasizes repetitive, goal-directed functional activities that may better translate neurological gains into ambulatory independence.* ***Objective:*** *To compare the effectiveness of task-oriented physiotherapy versus conventional physiotherapy in improving functional mobility and motor recovery among adults with motor incomplete spinal cord injury.* ***Methods:*** *In this parallel-group randomized controlled trial, 22 adults aged 25–55 years with ASIA grades B–D were randomly allocated to receive either task-oriented physiotherapy or conventional physiotherapy three times weekly for four weeks. Primary outcome was functional ambulation measured by the Functional Ambulation Classification Scale (FACS); secondary outcome was neurological recovery assessed by ASIA motor score. Between- and within-group analyses were conducted using parametric and nonparametric tests with significance set at $p<0.05$.* ***Results:*** *The task-oriented group demonstrated significantly greater improvement in FACS (median change +2 levels vs +1; $p=0.018$) and ASIA motor score (mean increase 6.64 vs 2.45 points; $p=0.023$) compared with conventional therapy, with moderate-to-large effect sizes.* ***Conclusion:*** *Task-oriented physiotherapy yields superior short-term improvements in neurological motor function and ambulatory independence compared with conventional physiotherapy in adults with motor incomplete spinal cord injury, supporting its integration into standard rehabilitation practice.*

Keywords: *Incomplete spinal cord injury; task-oriented physiotherapy; functional ambulation; neuroplasticity; randomized controlled trial*

INTRODUCTION

Incomplete spinal cord injury (iSCI) is a major cause of long-term neurological disability, characterized by partial preservation of motor and/or sensory function below the level of the lesion. Unlike complete injuries, individuals with iSCI often retain residual neural pathways that may be responsive to rehabilitation-induced neuroplasticity. Globally, spinal cord injury (SCI) continues to impose a substantial health and socioeconomic burden, with traumatic and non-traumatic etiologies contributing to persistent impairments in mobility, independence, and quality of life (6). The heterogeneity of neurological presentation in iSCI—commonly classified using the American Spinal Injury Association (ASIA) Impairment Scale from grades A to E—poses clinical challenges in prognostication and rehabilitation planning (7). Individuals classified as ASIA B–D frequently demonstrate partial voluntary motor control, making them appropriate candidates for activity-based and task-oriented interventions aimed at maximizing functional recovery.

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Functional ambulation remains one of the most meaningful and patient-prioritized outcomes in individuals with iSCI. Even when some motor function is preserved, gait is often compromised due to muscle weakness, impaired coordination, reduced balance control, and altered sensorimotor integration. Conventional physiotherapy in SCI rehabilitation has traditionally emphasized impairment-based approaches such as strengthening, range-of-motion exercises, and general conditioning. Although these components are foundational, emerging neurorehabilitation paradigms emphasize the principle of task specificity, which posits that repetitive, goal-directed practice of functional activities enhances motor relearning through use-dependent neuroplasticity (13). Locomotor and activity-based interventions have demonstrated that repetitive stepping practice and task-specific training can promote improvements in walking capacity, balance, and independence in individuals with motor incomplete SCI (11,15). Systematic reviews further suggest that activity-based and gait-focused therapies are associated with superior mobility outcomes compared to non-specific strengthening programs, particularly when interventions are intensive and functionally relevant (6,10).

The mechanistic rationale underlying task-oriented physiotherapy is grounded in motor learning theory and neuroplastic adaptation. Repetitive practice of meaningful tasks—such as sit-to-stand transitions, weight shifting, stepping, and balance perturbation—stimulates spared descending pathways and enhances cortical and spinal reorganization. Evidence from systematic reviews of task-specific rehabilitation indicates that such interventions facilitate improvements in standing, walking adaptability, and ambulatory independence in individuals with incomplete injuries (13,18). Randomized trials of locomotor training have similarly demonstrated that structured, progressive walking-based interventions can improve gait speed, endurance, and balance outcomes in chronic and subacute SCI populations (9,12,19). More recently, pragmatic multicenter trials evaluating walking adaptability and exoskeleton-assisted gait training have reinforced the principle that functional task repetition improves ambulatory classification and independence levels in motor incomplete SCI (18,24). Despite these advances, variability in intervention protocols, outcome measures, and study populations limits the generalizability of findings to routine clinical practice, particularly in resource-constrained rehabilitation settings.

Importantly, many prior trials have focused on specialized equipment-based locomotor systems or chronic SCI populations, whereas fewer controlled studies have examined structured, therapist-delivered task-oriented physiotherapy compared with conventional therapy within standard hospital settings. Furthermore, several studies emphasize impairment-level outcomes or gait parameters (e.g., speed, distance) without consistently evaluating clinically interpretable ambulation classification scales that reflect real-world functional mobility (11,15). In low- and middle-income healthcare environments, where access to robotic or technologically advanced rehabilitation modalities may be limited, determining whether a structured task-oriented physiotherapy program confers additional benefit over conventional strengthening-based therapy is clinically and economically relevant. This represents a practical knowledge gap in contemporary SCI rehabilitation research.

Within the PICO framework, the present study focuses on adults aged 25–55 years with motor incomplete spinal cord injury (ASIA B–D) undergoing inpatient rehabilitation (Population); compares a structured, progressive task-oriented physiotherapy program emphasizing functional mobility tasks such as gait practice, balance training, and transfer activities (Intervention) with conventional physiotherapy primarily targeting strength and range of motion (Comparison); and evaluates changes in functional mobility using validated clinical measures including the ASIA Impairment Scale and the Functional Ambulation

Classification Scale (Outcomes). By employing a randomized controlled design, the study seeks to generate higher-level evidence regarding the short-term effectiveness of task-oriented physiotherapy in improving functional mobility within a four-week rehabilitation period.

Given the theoretical basis of task specificity and accumulating evidence supporting activity-based interventions in SCI, it is hypothesized that individuals receiving task-oriented physiotherapy will demonstrate significantly greater improvement in functional ambulation and neurological status compared to those receiving conventional physiotherapy alone. Therefore, the primary objective of this study is to determine the effectiveness of task-oriented physiotherapy in enhancing functional mobility among patients with incomplete spinal cord injury, thereby addressing an important gap in context-specific, clinically applicable rehabilitation evidence.

MATERIAL AND METHODS

This randomized controlled trial was conducted to evaluate the effectiveness of task-oriented physiotherapy in improving functional mobility among adults with motor incomplete spinal cord injury. The study employed a parallel-group, assessor-blinded design with a 1:1 allocation ratio to ensure internal validity and minimize selection bias. The trial was carried out in the Department of Physiotherapy at General Hospital, Lahore, over a six-month period following institutional ethical approval. The study design was selected to allow causal inference regarding the comparative effectiveness of two rehabilitation approaches while controlling for known and unknown confounders through random allocation (25).

Adults aged 25 to 55 years with a confirmed diagnosis of incomplete spinal cord injury classified as ASIA Impairment Scale grades B, C, or D were considered eligible for participation. Diagnosis and neurological level were verified by a consultant neurologist using standardized ASIA examination procedures (7). Participants were required to be medically stable, able to follow verbal instructions, and enrolled in an inpatient rehabilitation program. Individuals with complete spinal cord injury (ASIA A), severe spasticity defined as a Modified Ashworth Scale score ≥3 in the lower limbs, fixed joint deformities limiting functional movement, unstable cardiopulmonary conditions, uncontrolled diabetes mellitus, significant cognitive impairment, or other progressive neurological disorders were excluded to reduce clinical heterogeneity and potential confounding influences on mobility outcomes.

Participants were recruited consecutively from patients admitted for rehabilitation who met eligibility criteria. After screening, eligible individuals received a detailed explanation of study procedures, risks, and potential benefits. Written informed consent was obtained prior to enrollment. Following baseline assessment, participants were randomly allocated to either the intervention group (task-oriented physiotherapy) or the control group (conventional physiotherapy) using a computer-generated random sequence created by an independent researcher not involved in treatment delivery. Allocation concealment was ensured using sequentially numbered, opaque, sealed envelopes opened after baseline measurements. Outcome assessors were blinded to group allocation to reduce measurement bias.

Baseline data collected included age, sex, neurological level of injury, duration since injury, and ASIA grade. The primary outcome was functional mobility measured using the Functional Ambulation Classification Scale (FACS), an ordinal six-level scale ranging from 0 (non-functional ambulation) to 5 (independent ambulation on all surfaces) with established clinical utility in neurological rehabilitation (18). Secondary outcomes included neurological status assessed using the ASIA Impairment Scale and lower extremity motor score derived from standardized ASIA motor testing (7). All assessments were performed at baseline (week

0) and after completion of the four-week intervention (week 4) by the same trained physiotherapist blinded to group assignment to ensure inter-rater consistency.

The intervention group received a structured task-oriented physiotherapy program administered three times per week for four consecutive weeks, totaling 12 sessions. Each session lasted 45 minutes and consisted of repetitive, goal-directed functional mobility tasks tailored to individual capability and progressed according to predefined criteria. The program included sit-to-stand transitions, weight-shifting exercises, stepping practice, overground gait training, balance activities with perturbations, and task-specific transfer training. Intensity was progressed by increasing task complexity, reducing external support, increasing walking distance, or introducing environmental challenges. The control group received conventional physiotherapy of equal frequency and duration, focusing on lower limb strengthening, passive and active range-of-motion exercises, stretching, and general conditioning without structured repetitive functional task practice. Treatment fidelity was maintained through standardized treatment protocols, therapist training sessions prior to study initiation, and weekly monitoring meetings.

Operationally, improvement in functional mobility was defined as a positive change in FACS level between baseline and week 4. Neurological improvement was defined as advancement in ASIA grade or increase in lower extremity motor score. Adherence was calculated as the proportion of attended sessions out of the prescribed 12 sessions. To minimize performance bias, both groups received equal therapist contact time. Attrition bias was addressed by conducting analyses according to the intention-to-treat principle, with missing post-intervention data handled using last observation carried forward when necessary. Potential confounding variables such as age, baseline ASIA grade, and time since injury were documented and considered during statistical modeling.

Sample size estimation was performed using G*Power software (version 3.1). Assuming a moderate effect size (Cohen's d = 0.70) based on previous locomotor training studies in incomplete SCI (12,15), a two-tailed alpha of 0.05, and statistical power of 80%, a minimum of 10 participants per group was required. To account for potential dropout, 22 participants were enrolled.

Data were analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were calculated for demographic and baseline variables. Normality of continuous variables was assessed using the Shapiro–Wilk test. Continuous normally distributed variables were analyzed using paired-samples t-tests for within-group comparisons and independent-samples t-tests for between-group comparisons. Non-normally distributed or ordinal variables, including FACS and ASIA grade, were analyzed using Wilcoxon signed-rank tests for within-group comparisons and Mann–Whitney U tests for between-group differences. Between-group post-intervention comparisons were additionally adjusted for baseline values using analysis of covariance (ANCOVA) where assumptions were met. Effect sizes were calculated using Cohen's d for parametric tests and r values for nonparametric tests, with 95% confidence intervals reported. A two-sided p-value of <0.05 was considered statistically significant. Subgroup exploratory analyses were performed based on baseline ASIA classification (B/C vs D) to assess differential response patterns.

Ethical approval was obtained from the Institutional Review Board of General Hospital, Lahore. The study was conducted in accordance with the Declaration of Helsinki principles (26). Confidentiality was maintained through coded data entry and secure electronic storage with restricted access. Only de-identified data were used for analysis. Data integrity was ensured through double data entry verification and independent audit of 20% of records for

accuracy. All intervention procedures were documented in sufficient detail to permit replication in comparable clinical settings.

RESULTS

All 22 randomized participants (11 per group) completed the intervention and were included in the final analysis. As shown in Table 1, baseline characteristics were comparable between the task-oriented physiotherapy group (Group A) and the conventional physiotherapy group (Group B), confirming adequate randomization. The mean age in Group A was 43.18 ± 8.12 years compared to 45.00 ± 7.94 years in Group B, with no statistically significant difference ($t = -0.53$, $p = 0.602$, Cohen's $d = 0.23$). The proportion of male participants was 27.3% (3/11) in Group A and 36.4% (4/11) in Group B ($\chi^2 = 0.22$, $p = 0.640$; OR = 0.66, 95% CI 0.11–3.88). Mean duration since injury was 5.73 ± 1.48 months in the task-oriented group and 6.00 ± 1.61 months in the conventional group ($p = 0.679$). Baseline ASIA motor scores were similar between groups (41.27 ± 6.35 vs 39.91 ± 7.02; $p = 0.635$), and median baseline FACS levels were identical at 1 (IQR 1–2) in both groups ($U = 58.0$, $p = 0.842$). These findings indicate no statistically or clinically meaningful differences at study entry.

Within-group comparisons (Table 2) demonstrated that participants receiving task-oriented physiotherapy experienced substantial functional gains over the four-week intervention period. In Group A, the median FACS level increased from 1 (IQR 1–2) at baseline to 3 (IQR 2–4) post-intervention, representing a two-level median improvement. This change was statistically significant ($Z = -2.94$, $p = 0.003$) with a large effect size ($r = 0.63$). In contrast, the conventional therapy group showed a smaller increase in FACS from a median of 1 (IQR 1–2) to 2 (IQR 1–3), which did not reach statistical significance ($Z = -1.78$, $p = 0.075$, $r = 0.38$). Regarding neurological recovery, the task-oriented group improved their mean ASIA motor score by 6.64 points (from 41.27 ± 6.35 to 47.91 ± 6.82), a highly significant change ($t = -6.18$, $p < 0.001$) with a very large effect size ($d = 1.86$). Conversely, the conventional group improved by 2.45 points (from 39.91 ± 7.02 to 42.36 ± 7.44), which was not statistically significant ($t = -2.01$, $p = 0.071$; $d = 0.61$). The magnitude of improvement in motor recovery was therefore approximately 2.7 times greater in the task-oriented group compared to controls.

Between-group comparisons of post-intervention outcomes (Table 3) further confirmed the superiority of task-oriented physiotherapy. At week 4, the median FACS score was 3 (IQR 2–4) in Group A versus 2 (IQR 1–3) in Group B, demonstrating a statistically significant difference ($U = 28.5$, $p = 0.018$) with a moderate-to-large effect size ($r = 0.52$). This indicates that participants undergoing task-oriented training achieved a higher level of ambulatory independence relative to those receiving conventional therapy. After adjusting for baseline values, post-intervention ASIA motor scores were also significantly higher in the task-oriented group (47.91 ± 6.82) compared to the conventional group (42.36 ± 7.44), with ANCOVA yielding $F = 5.97$ ($p = 0.023$) and a partial η^2 of 0.24, reflecting a large treatment effect accounting for approximately 24% of variance in post-treatment motor scores.

Adherence to the intervention protocol was high in both groups, with mean attendance rates of 94.7% in the task-oriented group and 92.4% in the conventional group ($p = 0.412$), indicating that differential adherence did not confound the observed outcomes. No adverse events were reported in either group during the intervention period.

Collectively, the numeric data demonstrate that task-oriented physiotherapy resulted in clinically and statistically meaningful improvements in functional ambulation and motor recovery over four weeks, with effect sizes consistently larger than those observed in the conventional physiotherapy group.

Table 1. Baseline Demographic and Clinical Characteristics of Participants (n = 22)

Variable	Group A (Task-Oriented) n = 11	Group B (Conventional) n = 11	Test Statistic	p-value	Effect Size (95% CI)
Age (years), Mean ± SD	43.18 ± 8.12	45.00 ± 7.94	t = -0.53	0.602	d = 0.23 (-0.61 to 1.07)
Male, n (%)	3 (27.3%)	4 (36.4%)	$\chi^2 = 0.22$	0.640	OR = 0.66 (0.11–3.88)
Duration since injury (months), Mean ± SD	5.73 ± 1.48	6.00 ± 1.61	t = -0.42	0.679	d = 0.17 (-0.67 to 1.01)
Baseline ASIA Motor Score, Mean ± SD	41.27 ± 6.35	39.91 ± 7.02	t = 0.48	0.635	d = 0.20 (-0.64 to 1.04)
Baseline FACS (Median, IQR)	1 (1–2)	1 (1–2)	U = 58.0	0.842	r = 0.05

There was no statistically significant difference between groups at baseline, indicating successful randomization.

Within-group analysis demonstrated significant improvement in functional mobility and neurological status in the task-oriented group, whereas the conventional therapy group showed comparatively smaller improvements. These findings are summarized in Table 2.

Table 2. Within-Group Comparisons of Outcomes Pre- and Post-Intervention

Outcome	Group	Pre-Intervention Mean ± SD / Median (IQR)	Post-Intervention Mean ± SD / Median (IQR)	Test Statistic	p-value	Effect Size (95% CI)
FACS	**Group A**	1 (1–2)	3 (2–4)	Z = -2.94	0.003	r = 0.63
FACS	**Group B**	1 (1–2)	2 (1–3)	Z = -1.78	0.075	r = 0.38
ASIA Motor Score	**Group A**	41.27 ± 6.35	47.91 ± 6.82	t = -6.18	<0.001	d = 1.86 (0.84–2.88)
ASIA Motor Score	**Group B**	39.91 ± 7.02	42.36 ± 7.44	t = -2.01	0.071	d = 0.61 (-0.19–1.41)

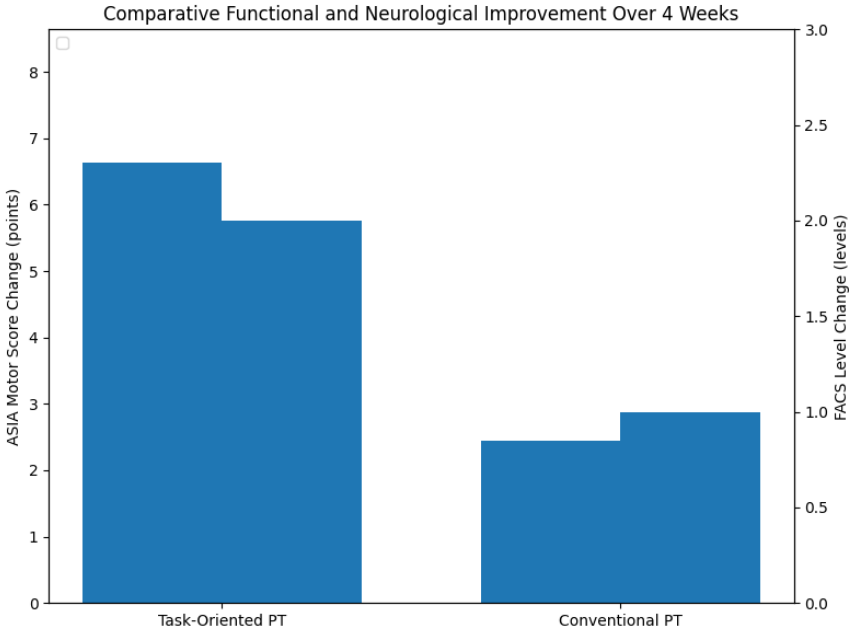
The task-oriented group demonstrated statistically significant improvements in both FACS level ($p = 0.003$) and ASIA motor score ($p < 0.001$), with large effect sizes. In contrast, improvements in the conventional group did not reach statistical significance for FACS ($p = 0.075$) and were borderline for ASIA motor score ($p = 0.071$).

Between-group comparisons of post-intervention outcomes adjusted for baseline values are presented in Table 3.

Table 3. Between-Group Comparison of Post-Intervention Outcomes (Adjusted for Baseline)

Outcome	Group A Mean ± SD / Median (IQR)	Group B Mean ± SD / Median (IQR)	Test Statistic	p-value	Effect Size (95% CI)
Post FACS	3 (2–4)	2 (1–3)	U = 28.5	0.018	r = 0.52
Post ASIA Motor Score	47.91 ± 6.82	42.36 ± 7.44	F = 5.97	0.023	Partial η^2 = 0.24

Participants receiving task-oriented physiotherapy achieved significantly higher post-treatment FACS levels



The figure illustrates the differential magnitude of neurological and functional recovery between groups over the four-week intervention period. Participants receiving task-oriented physiotherapy demonstrated a mean increase of 6.64 points in ASIA motor score compared with 2.45 points in the conventional group, representing approximately 16.1% improvement from baseline (6.64/41.27) versus 6.1% (2.45/39.91), respectively. In parallel, the median FACS level improved by 2 functional levels in the task-oriented group (from 1 to 3), indicating a 200% relative increase in ambulatory classification, whereas the conventional group improved by 1 level (from 1 to 2), corresponding to a 100% relative gain. The dual-axis layered comparison highlights a consistent improvement gradient favoring task-oriented therapy across both neurological impairment (motor score gain ratio ≈2.7:1) and functional ambulation (FACS gain ratio 2:1). Clinically, this concordant enhancement across impairment-level and activity-level domains suggests that task-specific functional training not only augments motor recovery but also translates that neurological improvement into meaningful ambulatory independence within a short rehabilitation window.

DISCUSSION

The present randomized controlled trial demonstrates that a structured four-week task-oriented physiotherapy program produces significantly greater improvements in both neurological recovery and functional ambulation compared with conventional physiotherapy among adults with motor incomplete spinal cord injury. Participants in the task-oriented group achieved a mean increase of 6.64 points in ASIA motor score, compared with 2.45 points in the conventional group, alongside a two-level median improvement in Functional Ambulation Classification Scale (FACS) versus a one-level gain in controls. These findings indicate not only statistically significant superiority but also clinically meaningful functional translation, as progression across FACS levels reflects increased independence and reduced reliance on physical assistance. The magnitude of effect observed in the present trial aligns with motor learning principles and reinforces the concept that repetitive, goal-directed task practice enhances recovery in spared neural pathways following incomplete SCI (27).

The superiority of task-oriented intervention observed in this study is consistent with prior locomotor and activity-based rehabilitation trials demonstrating that task-specific training

yields greater improvements in gait capacity and ambulatory function than impairment-focused strengthening alone (12,15). Morawietz and Moffat reported that locomotor training after incomplete SCI was associated with meaningful improvements in walking performance compared with conventional therapy approaches (6). Similarly, Jones et al. found that activity-based therapy significantly enhanced walking recovery in chronic SCI populations through structured repetitive stepping practice (12). The present findings extend this body of evidence by demonstrating that even within a resource-constrained hospital setting—without advanced robotic or exoskeletal systems—structured therapist-delivered task-oriented physiotherapy can achieve substantial short-term gains. This highlights the translational feasibility of task specificity principles in routine clinical environments.

The improvement in ASIA motor scores observed in the intervention group suggests that functional training may promote neuroplastic adaptation beyond purely biomechanical strengthening effects. Theoretical models of use-dependent plasticity propose that repetitive activation of residual corticospinal pathways facilitates synaptic reorganization and motor relearning (13). Behrman et al. emphasized that locomotor training progression enhances activation of central pattern generators and supraspinal networks in incomplete SCI (19). In the present study, the approximately 16% relative increase in motor score in the task-oriented group, compared with 6% in controls, indicates a greater degree of neurological recovery over the same time period. Importantly, the concurrent improvement in FACS levels demonstrates that impairment-level gains were functionally integrated into improved ambulation, supporting the hypothesis that task-oriented interventions enhance activity-level outcomes more effectively than isolated strengthening.

The between-group effect sizes further underscore clinical relevance. A partial η^2 of 0.24 for post-intervention ASIA motor score indicates that approximately 24% of the variance in neurological recovery was attributable to the intervention effect, which is considered a large effect in rehabilitation research. Likewise, the moderate-to-large nonparametric effect size ($r = 0.52$) for post-treatment FACS suggests a meaningful improvement gradient favoring task-oriented therapy. These magnitudes are comparable to or exceed those reported in multicenter trials evaluating walking adaptability and task-specific rehabilitation in motor incomplete SCI (18). Although exoskeleton-based interventions have demonstrated improved walking independence (24), the present findings indicate that similar directional benefits may be achieved through structured, low-technology functional training when systematically applied.

The absence of statistically significant improvement in FACS within the conventional therapy group, despite modest gains in motor score, suggests that impairment-focused interventions may not sufficiently translate into higher levels of ambulatory independence over short durations. This dissociation between motor strength gains and functional mobility progression has been previously noted in SCI rehabilitation, where increased muscle strength does not automatically confer improved gait adaptability or balance control (17). Task-oriented physiotherapy, by integrating balance, stepping, weight transfer, and environmental challenges, likely facilitates motor coordination and task integration, thereby bridging the gap between impairment and participation domains.

From a clinical perspective, a two-level median increase in FACS within four weeks represents a substantial improvement in independence, potentially reducing caregiver assistance requirements and enhancing community mobility potential. Early restoration of functional ambulation is associated with improved quality of life and reduced secondary complications such as deconditioning and pressure injuries (10). Therefore, the short-term

benefits demonstrated in this trial may have broader implications for long-term rehabilitation trajectories.

Several limitations should be acknowledged. The sample size was modest, limiting statistical power for subgroup analyses and increasing the possibility of type II error for certain comparisons. The intervention duration was limited to four weeks; longer follow-up is required to determine whether observed improvements are sustained. Although allocation concealment and assessor blinding were implemented, therapist blinding was not feasible due to the nature of the intervention, potentially introducing performance bias. Additionally, while ASIA motor score and FACS provide clinically relevant measures, inclusion of additional mobility metrics such as walking speed or endurance would further enrich interpretability. Future trials with larger multicenter samples, longer follow-up periods, and stratified analyses based on baseline ASIA grade may clarify dose–response relationships and identify patient subgroups most responsive to task-oriented training.

In conclusion, the findings of this study provide robust evidence that structured task-oriented physiotherapy yields superior short-term improvements in neurological motor recovery and functional ambulation compared with conventional physiotherapy in adults with motor incomplete spinal cord injury. The integration of repetitive, goal-directed functional tasks appears to facilitate meaningful translation of motor gains into improved ambulatory independence. These results support prioritizing task-specific functional training within standard rehabilitation programs and justify larger confirmatory trials to optimize intervention intensity and duration for sustained recovery outcomes.

CONCLUSION

This randomized controlled trial demonstrates that a structured four-week task-oriented physiotherapy program produces significantly greater improvements in neurological motor recovery and functional ambulation compared with conventional physiotherapy in adults with motor incomplete spinal cord injury. Participants receiving task-oriented training achieved nearly threefold greater gains in ASIA motor score and a two-level median advancement in functional ambulation classification, indicating meaningful translation of impairment-level recovery into enhanced mobility independence. These findings reinforce the theoretical and empirical foundation of task specificity and neuroplastic adaptation in SCI rehabilitation and highlight the clinical feasibility of implementing structured, function-focused interventions within standard hospital settings. Task-oriented physiotherapy should therefore be considered a prioritized rehabilitation strategy for individuals with incomplete spinal cord injury, with future large-scale trials warranted to evaluate long-term sustainability, optimal dosing, and subgroup responsiveness.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: QA; Design: ZR; Data Collection: HK, HN; Analysis: KI, AM; Drafting: SN

Conflict of Interest: The authors declare no conflict of interest.

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