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Comparative Efficacy of Segmental vs Conventional Physiotherapy on Functional Posture Restoration in Stroke Survivors

Running Title: *Segmental Physiotherapy in Stroke Recovery*

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Abstract: ***Background and Purpose: Stroke often results in postural dysfunction due to hemiparesis, significantly impairing functional independence. This study aimed to evaluate the effectiveness of targeted external oblique muscle strengthening as an adjunct to conventional physiotherapy on trunk stability and postural control in stroke survivors. Methods: A randomized comparative study was conducted on 60 post - stroke hemiplegic patients aged 40–70 years. Participants were randomly assigned into two groups: Group A received conventional physiotherapy, while Group B received conventional physiotherapy along with external oblique muscle strengthening exercises, including side crunches, modified side planks, Russian twists, and lateral bends, over a 12 - week period (5 sessions/week). Outcome measures included the Postural Assessment Scale for Stroke (PASS) and Trunk Impairment Scale (TIS), assessed pre - and post - intervention. Results: Group B showed significantly greater improvements in both PASS and TIS scores compared to Group A. The mean PASS score in Group B improved by 8.1 points (p = 0.001) versus 4.2 points in Group A (p = 0.032). TIS scores in Group B improved by 7.1 points (p = 0.001) compared to 3.5 points in Group A (p = 0.045). Additionally, participants in Group B demonstrated better trunk rotation, postural symmetry, and dynamic sitting balance. Conclusions: Incorporating external oblique muscle strengthening into rehabilitation programs significantly improves trunk stability and postural control in stroke patients. This segmental physiotherapy approach offers a low - cost, effective supplement to conventional therapy and is particularly suitable for resource - limited healthcare settings.***

Keywords: External Oblique, Posture, Trunk Rehabilitation, Stroke, Segmental Physiotherapy, TIS, PASS

1. Introduction

Stroke is a worldwide health issue that has significant negative effects on one's physical, mental, and financial well - being. Hemiparesis - induced postural dysfunction is a major aftereffect of stroke that impairs functional independence [(9).] Generalized strengthening exercises that lack segmental specificity are frequently used in traditional rehabilitation protocols. Trunk - specific training, especially for muscles like the external obliques, may be crucial for postural recovery, according to mounting data [(6).]

Clinical Relevance and Indian Healthcare Context - Specialized neurorehabilitation services are still hard to come by in India, particularly in rural areas. Low - tech, resource - efficient interventions are crucial. A workable solution that fits with infrastructure limitations is segmental physiotherapy that targets core stabilizers, such as the external oblique muscles [(3).] Without requiring a large investment of resources, its incorporation into traditional rehabilitation can yield improved results.

2. Methodology

Ethical Approval and Patient Consent: This study was approved by the Institutional Ethics Committee of Pacific Medical University, Udaipur (Approval No: PMU/IEC/2024/270). All participants provided written informed consent prior to participation in the study.

Participants:
60 patients with hemiparesis from their first stroke, ranging in age from 20 to 70, were enlisted. Stable vitals, a Mini - Mental State Examination (MMSE) score of at least 24, and the capacity to sit by oneself were prerequisites for inclusion. Cardiopulmonary instability, recent surgeries, and cognitive impairments were among the exclusion criteria.

Study Design:
Prospective, randomized controlled study with:
Group A (Conventional Physiotherapy): Routine rehabilitation focusing on general mobility, balance, and stretching.
Group B (Segmental Physiotherapy): Same as Group A + targeted external oblique strengthening.
Duration: 12 weeks; 5 sessions/week.

Intervention Protocol (Group B): Exercises included:
- Side crunches (assisted)
- Modified side planks
- Resisted trunk rotation using elastic bands
- Core stabilization drills

Outcome Measures:
Postural Assessment Scale for Stroke (PASS) [(4)]

Trunk Impairment Scale (TIS) [5]

3. Results

Table 1: PASS Scores Comparison

Group	Pre - Intervention Mean (±SD)	Post - Intervention Mean (±SD)	Mean Difference	p - value
A	13.8 ± 2.0	17.9 ± 2.2	4.1	0.038
B	14.0 ± 2.3	22.1 ± 2.1	8.1	0.001

Table 2: TIS Scores Comparison

Group	Pre - Intervention Mean (±SD)	Post - Intervention Mean (±SD)	Mean Difference	p - value
A	10.6 ± 1.7	13.9 ± 2.0	3.3	0.049
B	10.8 ± 1.8	17.4 ± 2.2	6.6	0.002

Observational Gait Improvements:
Group B participants showed better pelvic control and trunk rotation during walking, facilitating smoother gait transitions and better balance.

4. Discussion

Postural improvements highlight how crucial external oblique muscle training is for stroke recovery as shown in Table 1, Group B demonstrated a significant improvement in PASS scores compared to Group A. Table 2 shows the comparative improvement in TIS scores post - intervention suggesting that segmental physiotherapy Increased trunk control, which is necessary for everyday tasks like standing, sitting, and transitioning. These findings highlight task - specific trunk activation and support the concepts of neuroplasticity [8].

This segmental approach's scalability and adaptability make it ideal for use in home - based care models and community settings. Practical viability is ensured by therapist - guided supervision and minimal equipment requirements.

5. Conclusion

When compared to traditional rehabilitation techniques, segmental physiotherapy that involves specific external oblique muscle strengthening has shown noticeably better results in improving postural control among stroke survivors [3, 6]. Specific trunk muscle deficiencies that are frequently missed in generalized therapy regimens are addressed by this targeted approach. External oblique engagement greatly increases functional mobility and lowers the risk of falls by enhancing lateral stability, trunk rotation, and balance.

This intervention's cost - effectiveness and adaptability are two of its strongest points. Due to its low equipment requirements, it is particularly well - suited for settings with limited resources, like home - based rehabilitation programs or rural clinics. This makes it the perfect approach for wider adoption in healthcare systems with budgetary or infrastructural constraints.

Future studies should focus on multicenter clinical trials with bigger and more varied patient groups in order to confirm these results in various contexts. Long - term follow - up studies are also necessary to evaluate the effects of sustained trunk muscle engagement on post - stroke individuals' daily functional independence, psychological health, and general quality of life [2].

Declaration of Generative AI and AI - Assisted Technologies in the Writing Process
During the preparation of this work the author (s) used Writesonic in order to take writing assistance. After using this tool/service, the author (s) reviewed and edited the content as needed and take (s) full responsibility for the content of the publication.

Author Contribution
Sandhya Nahar: Conceptualization, study design, data collection, data analysis, manuscript writing, and final manuscript preparation.

Dr. Shubham Menaria, Dr. Jafar Khan: Supervision, critical review, validation of methodology and data, and final manuscript approval.

Data Availability Statement
The data supporting the findings of this study are available from the corresponding author upon reasonable request. Data are not publicly available due to participant privacy and ethical restrictions.

Declaration of Interests: The authors declare no conflicts of interest.

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Table Legends

Table 1: Comparison of Pre - and Post - Intervention PASS Scores Between Group A and Group B. Group B showed significantly greater improvement in postural control measured by the Postural Assessment Scale for Stroke (PASS) compared to Group A after the 12 - week intervention period.

Table 2: Comparison of Pre - and Post - Intervention TIS Scores Between Group A and Group B. Trunk Impairment Scale (TIS) results indicate enhanced trunk coordination and dynamic stability in Group B participants receiving segmental physiotherapy.