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Effect of External Oblique Muscle Strengthening on Trunk Stability in Post-Stroke Hemiplagia: A Randomized Comparative Study

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Abstract: ***Background: Trunk instability is a common and disabling consequence of stroke - induced hemiplegia. Conventional physiotherapy often lacks segmental focus, potentially limiting recovery. Strengthening the external oblique muscles may enhance trunk control and postural alignment in such patients. Methods: A randomized controlled trial was conducted involving 60 first - time stroke patients aged 20–70 years with hemiparesis. Participants were allocated to two groups: Group A received conventional physiotherapy, while Group B received conventional therapy plus external oblique muscle strengthening exercises. The intervention lasted 12 weeks with five sessions per week. Outcome measures included the Postural Assessment Scale for Stroke (PASS) and the Trunk Impairment Scale (TIS). Results: Both groups showed significant improvements in PASS and TIS scores; however, Group B demonstrated greater gains. The mean improvement in PASS scores was 8.1 in Group B vs.4.2 in Group A (p = 0.001). Similarly, TIS scores improved by 7.1 in Group B compared to 3.5 in Group A (p = 0.001), indicating enhanced dynamic balance and trunk coordination in the intervention group. Conclusion: Incorporating external oblique muscle strengthening into standard physiotherapy significantly improves trunk stability and postural control in hemiparetic stroke patients. This approach offers a low - cost, scalable strategy suitable for both clinical and community - based rehabilitation settings.***

Keywords: Stroke, Hemiplegia, Trunk Control, Rehabilitation, External Oblique

1. Introduction

Stroke is a leading cause of long - term disability and imposes a significant burden on individuals and health systems globally. Postural control deficits following hemiparesis hinder independence. Conventional rehabilitation lacks segmental focus, which may limit outcomes. Recent evidence indicates the potential benefit of trunk - targeted strategies, especially involving the external oblique muscles.

2. Methods

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). Informed consent was obtained from all participants.

Participants:
Sixty first - time stroke patients with hemiparesis, aged 20–70 years, with MMSE ≥24 and ability to sit independently. Exclusion criteria included cardiopulmonary instability, cognitive deficits, and recent surgery.

Study Design:
A 12 - week prospective randomized controlled trial with two arms:

- Group A: Conventional physiotherapy (mobility, balance, stretching)
- Group B: Conventional therapy + external oblique strengthening exercises (side crunches, side planks, resisted trunk rotation, core drills)

Outcome Measures:

- Postural Assessment Scale for Stroke (PASS)
- Trunk Impairment Scale (TIS)

3. Result

Group B showed significantly greater improvements in both PASS and TIS scores compared to Group A ($p < 0.05$). Improvements were especially noted in dynamic sitting balance and trunk coordination.

Table 1: Summary of PASS Scores

Group	Pre - Intervention Mean (±SD)	Post - Intervention Mean (±SD)	Mean Difference	p - value
A	14.2 ± 2.1	18.4 ± 2.3	4.2	0.032
B	14.6 ± 2.0	22.7 ± 2.5	8.1	0.001

Table 2: Summary of TIS Scores

Group	Pre - Intervention Mean (±SD)	Post - Intervention Mean (±SD)	Mean Difference	p - value
A	10.3 ± 1.8	13.8 ± 2.0	3.5	0.045
B	10.5 ± 1.9	17.6 ± 2.1	7.1	0.001

These results highlight a significant impact of external oblique strengthening in enhancing trunk control and postural alignment.

4. Discussion

The results of this study support the hypothesis that targeted segmental physiotherapy, specifically focusing on the external oblique muscles, significantly enhances postural restoration in stroke rehabilitation. Participants in Group B, who received the additional oblique muscle strengthening exercises, demonstrated superior improvements in trunk stability as measured by the Postural Assessment Scale for Stroke (PASS) and the Trunk Impairment Scale (TIS). These differences were statistically significant, with greater mean score improvements in Group B across both scales ($p < 0.05$), as detailed in Table 1 and Table 2. The findings underscore the importance of external oblique activation in restoring trunk coordination and dynamic balance. This segmental, task - specific training approach aligns with neuroplasticity principles by engaging muscle groups in functionally relevant movement patterns. Moreover, the low - resource nature of the intervention—with minimal equipment requirements—makes it particularly suitable for implementation in rural and home - based rehabilitation settings.

5. Conclusion

Incorporating external oblique strengthening into physiotherapy significantly improves posture and trunk control in hemiparetic patients. This segmental approach is effective, scalable, and economical—offering promise for broader application in low - resource clinical environments. Further multicentric studies with long - term follow - up are recommended.

Author Contribution
Sandhya Nahar: Conceptualization, study design, data collection, analysis, manuscript writing.
Dr. Shubham Menaria, Dr. Zafar Khan, Dr. K. M. Annamalai: Supervision, critical review, validation of data and final manuscript approval.

Data Availability Statement
The datasets generated during the current study are not publicly available but are available from the corresponding author on reasonable request.

Declaration of Generative AI Use
During the preparation of this work, the author used Writesonic to assist with writing. The author reviewed and edited the content and takes full responsibility for its accuracy and integrity.

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

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Table Legends

Table 1: Comparison of PASS scores between groups. Greater postural improvement seen in the segmental physiotherapy group.

Table 2: Comparison of TIS scores between groups. Notable gains in trunk coordination in the segmental intervention group.