E-ISSN: 2789-9403
P-ISSN: 2957-4579
The Superior Journal of Physical Therapy and Rehabilitation

Comparison of Sit to Stand Pattern in Subacute and Chronic Stroke Survivors

Sumaira Yasmin[1], Tehreem Mukhtar[2], Amna Ali[3], Sania Naz[4]

Original Article

ARTICLE INFORMATION

Corresponding Author:

- amnasundus123@gmail.com

Affiliations:

1. Lecturer (Govt College university Faisalabad Layah Campus)
2. Clinical Physiotherapist (Tehreem's Wellness Clinic)
3. Lecturer (Sutlej College of Allied Health Sciences Bahawalpur)
4. Lecturer (Government College university Faisalabad Layyah campus)

Key Words: Balance, Disability, Functional independence, Sit-to-stand (STS), Stroke.

ABSTRACT

Objective: This study was conducted to compare the movement of sit-to-stand (STS) on functional independence and disability in sub-acute and chronic stroke survivors.

Methodology: The study design was comparative cross-sectional. 30 patients of stroke were recruited in this study and divided into two groups: sub-acute and chronic stroke. Participants were recruited on the base of inclusion criteria and functional assessment protocol. Data was collected from DHQ Hospital, Layyah. Both subjective and objective assessments were conducted using the Mini-Mental State Examination (MMSE), Disability Index Scale, Functional Status Questionnaire, and Functional Independence Measure. SPSS version 21 was used for data analysis.

Findings: The mean age of participants was 49.07 ± 7.15 years, males were 43.33% and females were 56.67%. Ischemic stroke was 53.3 % and hemorrhagic was 46.7 %. MMSE scores were 22.73±2.21 for the sub-acute group and 27.33±1.83 for the chronic group. Disability Index Scale scores were 72±9.01 for sub-acute and 60.60±6.4 for chronic stroke survivors. Functional Independence Measure scores were 58.40±7.51 in the sub-acute group and 75.02±5.17 in the chronic group. The Functional Status Questionnaire was 65.60±6.97 for sub-acute and 72.20±2.97 for chronic stroke patients.

Conclusion: The sit-to-stand (STS) pattern was better in chronic stroke survivors compared to sub-acute survivors, indicating greater functional independence and lower disability in the chronic group.

Introduction:

With approximately 10.2% of all fatalities worldwide and 5.2% of all disabilities caused by stroke, as it is the second most common cause of death worldwide.(Sherin et al., 2020) Incident and prevalent strokes were higher in females (56.4 million prevalent strokes and 6.4 million incident strokes) than in males (45.0 million prevalent strokes and 5.8 million incident strokes). (Feigin et al., 2022) A stroke is a sudden onset of focal neurological deficit lasting more than 24 hours or leading to blood vessel damage. It may be a Transient ischemic attack (TIA) that affects the brain for less than 24 hours with complete recovery. Stroke is Ischemic stroke Hemorrhagic stroke, Intra-parenchyma hemorrhage (IPH), and Subarachnoid hemorrhage (SAH). (Naureen et al., 2024) To perform necessary functional activities like changing the position from seated to standing up, the general perception to perform daily living activities independently and without any external aid can be assessed (Ng et al., 2015). Understanding the mechanism of changing the position from sit-to-stand (STS) requires some natural parameters (Afzal et al., 2021). These parameters or factors are the age of the individual, height of the seat the individual is sitting on, armrests, the position of the feet on the floor, supporting muscles that assist in changing the position, and ability of the individual to control and maintain balance (Verrel, Lisofsky, Kühn, & Lindenberger, 2016). With time there is an observed increase in the severity of fear of falls especially with the change in position from sit-to-stand. while designing a comprehensive rehabilitation program for the improvement of quality of life after a cerebrovascular accident, the necessary interventions to improve sit-to-stand position and balance performance are still not sufficient (Chou et al., 2003).

The period of recovery from CVA is crucial because, during the recovery phase, the patient avoids putting weight on the affected side because of the previous trauma in the higher center, the representative area becomes weak, and putting weight on the affected limb generates discomfort and difficulty. This whole phenomenon ultimately affects the STS pattern (Nakamura & Ogata, 2016). Another problem addressed in chronic individuals is affected weaker limbs remain neglected which leads to the habit. When patients are used to ignoring weaker muscles it further stimulates and leads to disuse and ultimately learned nonuse phenomena occur and permanently deform the normal functioning pattern. (Kim, Lee, & An, 2010). Resulting in decreased efficiency of nervous pathways and inhibits weight bearing on affected leading to spasticity causing poor balance control sensorial problems and muscle weakness. This whole process is summoned up to induce poor postural control (Noh, Lim, Shin, & Paik, 2008). Depending on the suggestions provided by the kinematic movement theory and associated kinetic data there are four to six subdivided phases. (Radanovic, 2000). In Phases of a sit-to-stand movement cycle, subjects with hemiparesis after sub-acute cerebrovascular may create compensatory instruments that can influence dynamic mobility and ability to STS movement. (Guan et al., 2015). The act of this development, through systems that advance the weight bearing on the influenced leg for re-education and prevention from falls

(Radanovic, 2000). This study compared individually the main recognizable changes of the vertical power on feet or other objects, practically comparative powers bilaterally, where the subject is just getting out of the chair and beginning to gradually increase their hip size while standing.(BAKAR & OR, 2016)

The study was already present related to stroke survivors especially movement analysis for functional independence and disability, for the clinical evaluation and design of rehabilitation intervention after STS performance that provided useful information, and contributed for optimum functional recovery and outcomes of STS in sub-acute and chronic stroke

MATERIAL &METHODS

Methodology: This study compares the effects of sit-to-stand (STS) movement on functional independence and disability in sub-acute and chronic stroke survivors. This research was Comparative Cross-Sectional and data was collected by using convenient sampling from District Hospital Layyah. 36 patients will be recruited by assuming the attrition rate is 10% and a sample size of 34 is measured by G power software 3.1.9.2 with a margin error of 5% is 1.96 and 80% power. A sample of 30 subjects was enrolled in this study.(Shimizu, Hashidate, Ota, & Kawai, 2023) The sample size was calculated using Epi-Tool (Fig 1). Subjects were divided into two groups: sub-acute stroke and chronic stroke. This study was registered by the Ethical Committee with Ref no. REC/RCR & AHS 20/2017 On January 1, 2020. The data was collected within 6 months of approval of synopsis. The study included participants after 3 months of stroke as in the sub-acute phase while more than 6 months patients included in chronic stroke patients. (Estrada-Barranco, Cano-de-la-Cuerda, Abuín-Porras, & Molina-Rueda, 2021) with age 40-65 and included after a first attack of CVA with unilateral motor deficit (Britton, Harris, & Turton, 2008), an MMSE score was 25 was included in this study. The participants were excluded with Deep sensory deficit (Cheng, Wu, Liaw, Wong, & Tang, 2001) or Bilateral hemiplegia or foot drop (Chou et al., 2003) and severe cognitive impairment or stroke attack less than 3 months.

Data Collection Tools

Data was collected by Functional Status Questionnaire is used to evaluate the functional recovery of stroke during sub-acute and chronic stroke. Whose functional domains include mental status, sensory communication and motor function, feeding and respiratory. Final score ranges from 6-30 (Britton et al., 2008). The disability index scale is a physical disability evaluator used to measure functional disability. Chroanbach alpha coefficient value of 0.91(Gao et al., 2021) This test is considered the gold standard of low back functional outcome. Each of 10 items is scored from0-5 (Mong, Teo, & Ng, 2010). Functional independent measure is used to evaluate patient psychological, physical functions and its α coefficient ≥ 0.84 (Spearman's correlation coefficient, $r_s \geq 0.92$(Hsueh, Lin, Jeng, & Hsieh, 2002), When assessing a patient's functional condition during rehabilitation, FIM is frequently utilized. Eighteen items make up the FIM, which assesses the patient's degree of disability and care burden. Thirteen of the items identify motor function disability, and five indicate cognitive function disability. (Cheng et al., 2001). With the Mini-Mental State Examination, six cognitive domains were assessed: language, orientation, memory, attention, and arithmetic. From 0 to 30, the total score fluctuates. (Hirschfeld, Thorsteinsdottir, & Olsson, 1999).

DATA ANALYSIS

The data was analyzed using SPSS version 21. Mean and standard deviation was used to measure significant difference across the two groups.

RESULTS

In this study, the results are concluded on basis of STS in sub-acute and chronic strokes. Functional level and quality of living is accessed by different scales or assessment tools. Stroke affects mostly females either in sub-acute or chronic cases. Functional capacity was more in chronic cases when assessed through the Functional Status Questionnaire. The mean disability index, functional independence measure, and Minimal mental state examination were high among chronic cases as compared to sub-acute cases.

Demographics of patients:

Table 1 Distribution of demographic variables across two groups

			Mean	Std. Deviation
Descriptive Statistics	**Sub-Acute**	Duration(weeks)	8.26	1.66
		Age	49.80	6.17
	Chronic	Duration(weeks)	58.13	4.38
		Age	48.33	8.89
Demographics			**Frequency**	**Percent**
Gender		Male	13	43.3
		Female	17	56.7
	Sub-Acute	Male	6	40.0
		Female	9	60.0
	Chronic	Male	7	46.7
		Female	8	53.3
Type of Stroke		Ischemic	16	53.3
		Hemorrhagic	14	46.7
Groups	**Sub-Acute**	Ischemic	10	66.7
		Hemorrhagic	5	33.3
	Chronic	Ischemic	6	40.0
		Hemorrhagic	9	60.0

Thirty patients were included with ages 49.07 ± 7.15 years (Fig 2). Male was 43.33% and female was 56.67%. sub-acute was recruited with mean age 49.8±6.17 with duration 8.26±1.66 in weeks while, chronic stroke patients showed age 48.33±8.8 and duration from onset of stroke was 58.16±4.38 in weeks. Male patients with sub-acute was 40% and in chronic 46% (Fig 3) while number of females were more in sub-acute 60% as well as 56% with chronic phase. In types of stroke Ischemic Stroke was 53.3 % and hemorrhagic was 46.7 %. While in Sub-acute cases were mostly among Ischemic cases 66.7% and the percentage of Hemorrhagic cases 60.0% was chronic (Table 1)

Table 2: Results of all scales

Scale	Group A (Subacute) Mean ± SD	Group (B) (Chronic) Mean ± SD	P-value
Minimal Mental State Examination	22.73±2.21	27.33±1.83	.000
Disability Index Scale	72±9.01	60.60±6.45	.000
Functional Independence Measure	78.40±7.51	80±5.17	.000

Functional Status Questionnaire	65.60±6.97	75.53±8.29	.003

Functional status of chronic and sub-acute patients:

MMSE scores were 22.73±2.21 for the sub-acute group and 27.33±1.83 for the chronic group. Disability Index Scale scores were 72±9.01 for sub-acute and 60.60±6.4 for chronic stroke survivors. Functional Independence Measure scores were 58.40±7.51 in the sub-acute group and 75.02±5.17 in the chronic group. The Functional Status Questionnaire was 65.60±6.97 for sub-acute and 72.20±2.97 for chronic stroke patients.. (Table 2)

Figure 2: Bar chart showed Age of stroke patients

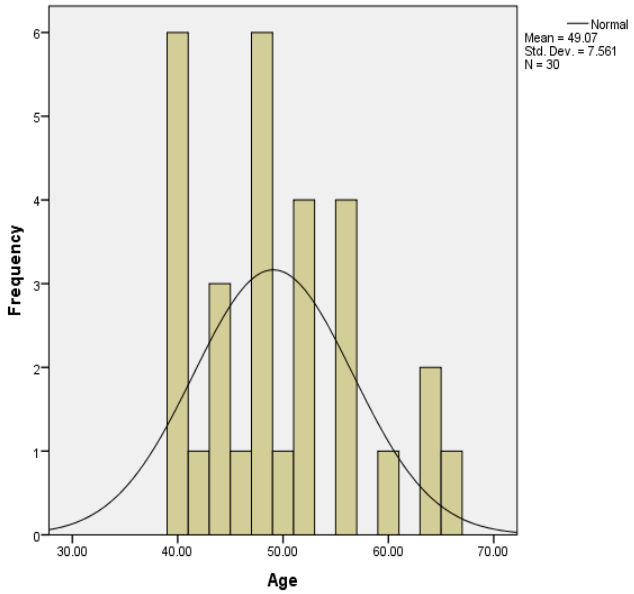
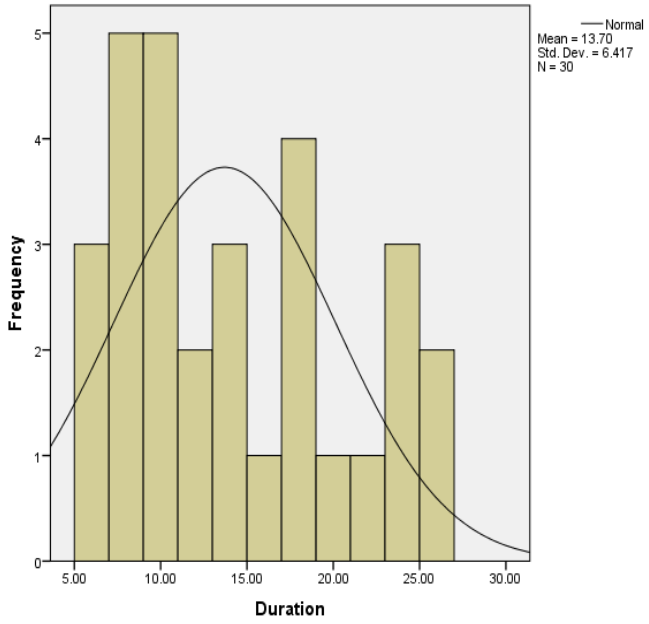


Figure 3: Bar chart showed sub-acute and chronic stroke patients



DISCUSSION

In this study, Practical status and estimating scales were used to examine and investigate the stages and temporary purposes of kinematic and active contrasts of STS movement in sub-acute stroke survivors and compare those and age-coordinated chronic stroke survivors. This study concluded that the STS task was fundamentally longer in the sub-acute stroke when compared with persistent stroke survivors. Decreased speed in remaining from pre sitting position is direct to the difficulty in standing up in sub-intense stroke survivors (Mong et al., 2010). Chou SW et al. study conducted on the effects of STS and gait activities in stroke patients. The study concluded that hemiplegic patients had better gait performance than the other patients, who could maximize vertical force and stand up within 4.5 sec. (Chou et al., 2003) Shamay S.M. Ng. et al. conducted a study on the five times sit-to-stand test (FTSTS) to assess the functional movement of the lower limbs in older adults and its relation with foot and arm placement. So, the study concluded that arm placement is not related to foot placement nor with balance off or risk of fall, but standard foot placement is used to prevent imbalance and risk of fall.(Ng et al., 2015)

Hirschfield et al. analyzed that during STS, whole-body kinematics and ground forces from the feet and buttocks were measured. It is determined that the start and end of the weight transfer process are programmed and body equilibrium is maintained during the process by measuring the center of mass, anterior and posterior velocities, and the forward-directed force from its commencement to its peak. The study's disability index results indicated a notable improvement in weight shifting. In this study, the disability index scores showed significant improvement in weight shifting during STS in stroke survivors compared to sub-acute counterparts (Hirschfeld et al., 1999). Another study concluded that functional improvement was less with traditional rehabilitation therapy than with Constraint-Induced Movement Therapy in their patients. (Waris et al., 2021) Brière A, et al. evaluate post-stroke individuals' perceived knee effort performing STS tasks in different foot positions in order to measure their weight-bearing errors, and they concluded that the variations brought about by the varied foot positions caused more problems with the knee effort distribution than with the weight-bearing. (Brière, Nadeau, Lauzière, & Gravel, 2013) Shimizu et al. Concluded that sub-acute stroke individuals who completely perform sit-to-stand, standing, and STS could increase the opportunity to perform Low-intensity physical activities. (Shimizu et al., 2023) Wang et al. conducted a study on Post-stroke patients with a muscle activation electromyography (EMG) that diagnosed and access the motor functional level and motor impairment especially for STS in post-stroke. This results and conclusions is useful to understand recovery process of motor activity in the post-stroke, and it is the more effective for future stroke survivors in their rehabilitation strategy (Wang et al., 2022).

According to Li et al., study the non-paretic side adjusted to biomechanical deviations, whereas the paretic side displayed aberrant changes in muscle synergies after the stroke. Modifications in muscle synergies and exoskeleton-based training improved lower-limb function post-stroke. (Li et al., 2023) Another study supports this study, long-term gains in STS performance and weight-bearing strategies that powerful factors contribute to the improvement in STS in chronic stroke (Vive, Zügner, Tranberg, & Bunketorp-Käll, 2024) Kılınç et al. conducted a systematic review that proved that, different biomechanics in the back and lower body during sit-to-stand (STS) tasks between healthy and stroke patients. Therapeutic

interventions are required to improve their functional task in daily life. (Kılınç, De Ridder, Kılınç, & Van Bladel, 2023) Another study supports the effectiveness of a tailored sitting Tai Chi program among sub-acute stroke survivors in improving recovery outcomes. (Zhao et al., 2022) They conducted a Randomized Clinical trial that included 24 participants with sub-acute stroke age. Participants were randomly divided into two groups. Both the experimental and control groups underwent three weekly sessions of standard physical therapy treatment, while the experimental group underwent equal weight-bearing STS exercise. This study concluded that experimental group routine therapy with equal weight-bearing STS exercise was an effective treatment to improve balance in sub-acute stroke patients. (Zhan, Liu, Xu, & Zhu, 2023)

Limitations:

This study has several limitations which limit the interpretation of the data. The study design was confined to cross cross-sectional study. No interventions were used. The sample size was limited. Equal numbers of Hemorrhagic and ischemic patients should be added in sub-acute and chronic stages for better results.

CONCLUSION

Chronic stroke survivors showed a better sit-to-stand (STS) pattern than sub-acute survivors, reflecting greater functional independence and reduced disability.

Recommendations

For further studies should be used all three phases including acute sub-acute and chronic and optimize neuro-recovery in the different stages of stroke rehabilitation. The study should be conducted with a longitudinal study design and increase the sample size. For accessing better STS can be used Electromyography and dynamometer for accessing muscle strength of lower extremities.

Conflict of Interest: All the authors have indicated that they have no conflicts.

Financial disclosure: The article's developed components were not funded.

Disclaimer: None to declare

REFERENCES:

1. Afzal, B., Mukhtar, T., Butt, G. A., Bashir, A., Manzoor, S., & Abbas, S. N. (2021). Effects of Proprioceptive Neuromuscular Facilitation (PNF) Techniques on Bed Mobility, Transfer and Early Trunk Control in Acute Stroke Patients. Journal of Pharmaceutical Research International, 33(44B), 540-545.
2. BAKAR, A., & OR, N. I. (2016). BYUN, Tae Joon 3PS-28 BYUN, Yongro 2PS-350 BYUN, Youngro IL9-29. 고분자 과학과 기술, 27(4), 405.
3. Brière, A., Nadeau, S., Lauzière, S., & Gravel, D. (2013). Perception of weight-bearing and effort distribution during sit-to-stand in individuals post-stroke. Perceptual and Motor Skills, 117(1), 166-181.
4. Britton, E., Harris, N., & Turton, A. (2008). An exploratory randomized controlled trial of assisted practice for improving sit-to-stand in stroke patients in the hospital setting. Clinical Rehabilitation, 22(5), 458-468.
5. Cheng, P.-T., Wu, S.-H., Liaw, M.-Y., Wong, A. M., & Tang, F.-T. (2001). Symmetrical body-weight distribution training in stroke patients and its effect on fall prevention. Archives of physical medicine and rehabilitation, 82(12), 1650-1654.
6. Chou, S.-W., Wong, A. M., Leong, C.-P., Hong, W.-S., Tang, F.-T., & Lin, T.-H. (2003). Postural control during sit-to stand and gait in stroke patients. American journal of physical medicine & rehabilitation, 82(1), 42-47.
7. Estrada-Barranco, C., Cano-de-la-Cuerda, R., Abuín-Porras, V., & Molina-Rueda, F. (2021). Postural assessment scale for stroke patients in acute, subacute and chronic stage: A construct validity study. Diagnostics, 11(2), 365.
8. Feigin, V. L., Brainin, M., Norrving, B., Martins, S., Sacco, R. L., Hacke, W., . . . Lindsay, P. (2022). World Stroke Organization (WSO): global stroke fact sheet 2022. International Journal of Stroke, 17(1), 18-29.
9. Gao, Y., Wang, Y., Li, D., Zhao, J., Dong, Z., Zhou, J., . . . Zhang, J. (2021). Disability assessment in stroke: Relationship among the pictorial-based Longshi Scale, the Barthel Index, and the modified Rankin Scale. Clinical Rehabilitation, 35(4), 606-613.
10. Guan, Q., Jin, L., Li, Y., Han, H., Zheng, Y., & Nie, Z. (2015). Multifactor analysis for risk factors involved in the fear of falling in patients with chronic stroke from mainland China. Topics in stroke rehabilitation, 22(5), 368-373.
11. Hirschfeld, H., Thorsteinsdottir, M., & Olsson, E. (1999). Coordinated ground forces exerted by buttocks and feet are adequately programmed for weight transfer during sit-to-stand. Journal of neurophysiology, 82(6), 3021-3029.
12. Hsueh, I.-P., Lin, J.-H., Jeng, J.-S., & Hsieh, C.-L. (2002). Comparison of the psychometric characteristics of the functional independence measure, 5 item Barthel index, and 10 item Barthel index in patients with stroke. Journal of Neurology, Neurosurgery & Psychiatry, 73(2), 188-190.
13. Kılınç, Ö. O., De Ridder, R., Kılınç, M., & Van Bladel, A. (2023). Trunk and lower extremity biomechanics during sit-to-stand after stroke: A systematic review. Annals of physical and rehabilitation medicine, 66(3), 101676.
14. Kim, S.-y., Lee, J.-h., & An, S.-h. (2010). The clinical application of modified emory functional ambulation profile for chronic stroke patients. Journal of Korean Society of Physical Medicine, 5(4), 655-666.
15. Li, Y.-A., Chen, Z.-J., He, C., Wei, X.-P., Xia, N., Gu, M.-H., . . . Huang, X.-L. (2023). Exoskeleton-assisted sit-to-stand training improves lower-limb function through modifications of muscle synergies in subacute stroke survivors. IEEE Transactions on Neural Systems and Rehabilitation Engineering.
16. Mong, Y., Teo, T. W., & Ng, S. S. (2010). 5-repetition sit-to-stand test in subjects with chronic stroke: reliability and validity. Archives of physical medicine and rehabilitation, 91(3), 407-413.
17. Nakamura, K., & Ogata, T. (2016). Locomotive syndrome: definition and management. Clinical Reviews in Bone and Mineral Metabolism, 14, 56-67.
18. Naureen, S., Mukhtar, T., Taufiq, F., Rashid, K., Maryaum, R., & Kanwal, N. (2024). Gait Variability and its Relationship to Functional Mobility in Hemiparetic

Stroke. Journal of Health and Rehabilitation Research, 4(1), 753-758. doi: 10.61919/jhrr.v4i1.502

19. Ng, S. S., Kwong, P. W., Chau, M. S., Luk, I. C., Wan, S. S., & Fong, S. S. (2015). Effect of arm position and foot placement on the five times sit-to-stand test completion times of female adults older than 50 years of age. Journal of Physical Therapy Science, 27(6), 1755-1759.
20. Noh, D. K., Lim, J.-Y., Shin, H.-I., & Paik, N.-J. (2008). The effect of aquatic therapy on postural balance and muscle strength in stroke survivors—a randomized controlled pilot trial. Clinical Rehabilitation, 22(10-11), 966-976.
21. Radanovic, M. (2000). Características do atendimento de pacientes com acidente vascular cerebral em hospital secundário. Arquivos de Neuro-psiquiatria, 58, 99-106.
22. Sherin, A., Ul-Haq, Z., Fazid, S., Shah, B. H., Khattak, M. I., & Nabi, F. (2020). Prevalence of stroke in Pakistan: Findings from Khyber Pakhtunkhwa integrated population health survey (KP-IPHS) 2016-17. Pakistan journal of medical sciences, 36(7), 1435.
23. Shimizu, N., Hashidate, H., Ota, T., & Kawai, Y. (2023). Physical activity according to sit-to-stand, standing, and stand-to-sit abilities in subacute stroke with walking difficulty: a cross-sectional study. Physiotherapy Theory and Practice, 39(11), 2327-2335.
24. Verrel, J., Lisofsky, N., Kühn, S., & Lindenberger, U. (2016). Normal aging increases postural preparation errors: Evidence from a two-choice response task with balance constraints. Gait & Posture, 44, 143-148.
25. Vive, S., Zügner, R., Tranberg, R., & Bunketorp-Käll, L. (2024). Effects of enriched task-specific training on sit-to-stand tasks in individuals with chronic stroke. NeuroRehabilitation(Preprint), 1-12.
26. Wang, R., An, Q., Yang, N., Kogami, H., Yoshida, K., Yamakawa, H., . . . Yokoyama, M. (2022). Clarify sit-to-stand muscle synergy and tension changes in subacute stroke rehabilitation by musculoskeletal modeling. Frontiers in systems neuroscience, 16, 785143.
27. Waris, M., Afzal, A., Mukhtar, T., Afzal, B., Waris, S., & Ain, Q.-U. (2021). Comparison of Constraint-Induced Movement Therapy Vs Traditional Rehabilitation Therapy to Improve Upper Limb Function in Hemiplegic Acute and Subacute Stroke Patients. Pakistan Journal of Medical and Health Sciences, 15, 3021-3025. doi: 10.53350/pjmhs2115103021
28. Zhan, W., Liu, J., Xu, Z., & Zhu, L. (2023). A Comparison of Sit to Stand Movement between Stroke Subjects and Healthy Subjects. International Journal of Frontiers in Medicine, 5(6).
29. Zhao, J., Chau, J. P. C., Chan, A. W. K., Meng, Q., Choi, K. C., Xiang, X., . . . Li, Q. (2022). Tailored sitting Tai Chi program for subacute stroke survivors: a randomized controlled trial. Stroke, 53(7), 2192-2203.

CONFLICT OF INTEREST

Authors declared no conflict of interest, whether financial or otherwise, that could influence the integrity, objectivity, or validity of their research work.

GRANT SUPPORT AND FINANCIAL DISCLOSURE

Authors declared no specific grant for this research from any funding agency in the public, commercial or non-profit sectors

DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request

SJPTR web address: www.sjptr.pk
Email address: sjptr@superior.edu.pk