2024, Retos, 56, 744-750

Realizo actividad física mientras opero una silla de ruedas: una revisión sistemática de pacientes con acv
I engage in physical activity while operating a wheelchair.: a systematic review of stroke patients

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Abstract. Introduction: Stroke is a major contributor to mortality rates in numerous nations, resulting in enduring challenges for individuals who have survived the condition in doing routine tasks. The chair-stand exercise was implemented as a distinct intervention, clearly differentiated from a convalescent rehabilitation program. The objective of this study is to gather empirical data on the movement of stroke patients in wheelchairs used by healthcare professionals, given the current lack of clarity in clinical practices. Method: Studies were obtained from PubMed, Embase, Cochrane Library, EBSCO, Web of Science, and CNKI. Only randomized controlled trials were left to evaluate exercises suitable for wheelchair-using stroke patients, and with no restrictions on data or study language. Result: Specifically, six studies utilized interventions such as Trunk Stability, Sit And Stand Independently, Sitting Posture and Trunk Control, Monkey Chair And Band System, Beach Chair Position, and Chair-Stand Exercise. Conclusion: The study's positive outcomes illustrate that engaging in wheelchair exercise can have a beneficial effect and improve the capacities of individuals who have experienced a stroke. Wheelchair users employ many strategies to improve their functioning abilities.
Keyword: Sitting Position, Stroke, Wheelchairs, Delivery of Health Care

Resumen. Introducción: El accidente cerebrovascular es un importante contribuyente a las tasas de mortalidad en numerosos países, lo que resulta en desafíos duraderos para las personas que han sobrevivido a la afección al realizar tareas rutinarias. El ejercicio de posición en silla se implementó como una intervención distinta, claramente diferenciada de un programa de rehabilitación de convalecientes. El objetivo de este estudio es recopilar datos empíricos sobre el movimiento de los pacientes con ictus en sillas de ruedas utilizadas por los profesionales sanitarios, dada la actual falta de claridad en las prácticas clínicas. Método: Los estudios se obtuvieron de PubMed, Embase, Cochrane Library, EBSCO, Web of Science y CNKI. Sólo quedaron ensayos controlados aleatorios para evaluar ejercicios adecuados para pacientes con accidente cerebrovascular que utilizan sillas de ruedas, y sin restricciones en cuanto a los datos o el lenguaje del estudio.
Resultado: Específicamente, seis estudios utilizaron intervenciones como estabilidad del tronco, sentarse y pararse de forma independiente, postura sentada y control del tronco, sistema de banda y silla de mono, posición de silla de playa y ejercicio de pie en silla. Conclusión: Los resultados positivos del estudio ilustran que realizar ejercicio en silla de ruedas puede tener un efecto beneficioso y mejorar las capacidades de las personas que han sufrido un derrame cerebral. Los usuarios de sillas de ruedas emplean muchas estrategias para mejorar sus capacidades funcionales.
Palabra clave: Posición sentada, Accidente cerebrovascular, Sillas de ruedas, Prestación de atención sanitaria

Fecha recepción: 05-01-24. Fecha de aceptación: 24-04-24
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Introduction

Stroke is a predominant cause of mortality in numerous nations, resulting in enduring challenges for survivors in performing routine activities. It is worth mentioning that a significant proportion, precisely over two-thirds, of stroke survivors engage in rehabilitation programmes subsequent to their admission to the hospital (Matsushita et al., 2019). Moreover, empirical studies have shown that around fifty percent of stroke survivors who undergo rehabilitation develop sarcopenia, a medical condition characterised by a decline in the capacity to carry out routine activities of daily living (ADL) subsequent to the occurrence of a stroke (S.-Y. Kim et al., 2024). Hence, it is imperative to address sarcopenia through the integration of dietary and exercise interventions within the framework of stroke treatment. It is widely recognised that stroke is the leading cause of impairment in performing activities of daily living (Yoshimura et al., 2017). The ability to control one's trunk is an essential component in performing activities of daily living (ADLs). Adequate core stability is critical for preserving balance and facilitating the effective execution of lower extremity movements in both routine daily activities and more complex undertakings (M. Park et al., 2022). Additionally, it positively influences the functionality of the upper extremities. A decrease in anticipatory activity in the trunk muscles of stroke patients was identified by Dickstein et al. (Nagano et al., 2020). Consequently, enhancing trunk stability constitutes a significant proportion of stroke patients' primary therapeutic objective. Primarily, rehabilitation interventions ought to aim to maximise the activation levels of the rectus abdominis, latissimus dorsi, and external oblique muscles on the side that has been injured.

The biomechanical capability evaluations conducted on an individual are influenced by the physical attributes of the chair. Similarly, it has an impact on the Five Times Sit-to-Stand Test (5STSt) performance of stroke patients (Sato et al., 2022). By modifying the chair to correspond with the anthropometric characteristics of each individual, it is possible to assess their actual capability to perform sit-to-stand

activities. It appears that employing a modified chair is the most appropriate approach to performing the 5STSt. In light of this, it is recommended that future research employ this methodology, notwithstanding the fact that chairs featuring consistent height and depth dimensions are more readily available in clinical environments. An additional study investigated the utilisation of various chair types and the duration of trials in the five-repetition sit-to-stand test when matched healthy individuals and stroke patients according to their individual attributes (N. Kim & Choi, 2023).

Introduced the chair-stand exercise as a distinct independent intervention, differentiating it from a convalescent rehabilitation programme (Yoshimura et al., 2018). In order to accommodate the patient's physical characteristics, the saddle height of the chair, platform, or wheelchair was adjusted to an approximate range of 40-50 cm. The patients were provided with parallel bars and handrails as needed, and rehabilitation clinicians assisted those who struggled to independently transition to a standing position. During every session, the participants were instructed to engage in a continuous sit-to-stand exercise for twenty minutes. Each participant was directed to perform the sit-to-stand exercise for a duration of approximately 8 seconds, for a total of 120 repetitions. The participants were instructed to tally aloud every instance of chair-standing motions, thereby fostering an animated and enjoyable group environment. This particular exercise differs from other whole-body exercises frequently suggested for senior individuals, including balance balls, squats, and lunges, in that it is characterised by a reduced intensity and a slowed cadence. In general, this entails carrying out 20-30% of the utmost number of repetitions per session. By deliberately implementing this approach, the health and vitality of elderly individuals with limited physical capabilities are effectively improved concurrently (Ryan et al., 2017). Furthermore, a plausible expectation is that the patient's physical independence will increase, given the robust correlation observed between this particular movement and activities of daily living (Kızılarslanoğlu, 2020). The research article, "The Effects of Chair-Stand Rehabilitation on Sarcopenia in Stroke Patients undergoing Rehabilitation," examines the correlation between the chair-stand exercise and sarcopenia in patients undergoing rehabilitation for stroke (Kerr et al., 2017).

Among stroke patients with dysphagia, there is a direct correlation between the chair-stand exercise and improvement in activities of daily living (ADL). This discovery suggests that the inclusion of repetitive chair-stand exercises, for a maximum of three hours daily, in a convalescent rehabilitation regimen improves these patients' ability to perform activities of daily living (ADL). A number of therapeutic guidelines advocate for the incorporation of total-body exercise regimens in sarcopenia treatment. Hence, engagement in a chair-stand routine incorporating resistance training of moderate intensity possesses the potential to enhance performance in activities of daily living (ADL). In addition, the chair-stand exercise possesses the potential to enhance the execution of routine daily activities (ADLs). The physical rehabilitation regimen, which incorporates the sit-to-stand motion executed from a seated position, has exhibited the capacity to improve the holistic well-being of stroke survivors managing physical impairments. Furthermore, engaging in physical activity does not necessitate specialised apparatus or facilities, can be performed inexpensively, and can be performed individually or in groups of varying sizes, including hospital rehabilitation settings. There exists a theoretical correlation between increased proficiency in activities of daily living (ADL) and a reduced duration of hospitalisation. Consequently, a hypothesis posits that the chair-stand exercise expedites the discharge of patients by indirectly enhancing the execution of routine activities. Research has demonstrated that reducing the duration of hospital visits can effectively enhance patients' health and decrease healthcare expenditures. Stroke recovery procedures must therefore incorporate rigors physical training, including chair-stand exercises. According to a study by Yoshimura et al. (2020), the integration of the chair-stand exercise into post-stroke dysphagia treatment has demonstrated efficacy (Yoshimura et al., 2020).

The objective of this research endeavour is to amass empirical data regarding the mobility of stroke patients who are confined to wheelchairs and are observed by healthcare professionals. This is done in consideration of the current lack of clarity surrounding clinical practices. To be more precise, this involves conducting a systematic analysis to investigate data from published studies that detail interventions and observations of stroke therapies in humans.

Method

Protocol and registration

The systematic review was carried out using the parameters specified in the Preferred Reporting Items for Systematic Reviews (PRISMA) guidance. This study is a thorough examination of data that is available to the public, eliminating the need for ethical approval. The published protocol offers a thorough elucidation of the technique utilized in the systematic review. This encompasses information regarding the search method, which entailed the independent dual screening performed by two reviewers, dual data extraction, dual appraisal of included articles to evaluate the risk of bias, and the process of narrative synthesis.

Search Strategy

A complete search strategy has been established, integrating key phrases and their synonyms pertaining to the subject of stroke, such as "cerebrovascular disease, Physical Activity, Wheelchair Use, Stroke Patients, Engaging in Physical Activity, Mobility Impairment, Rehabilitation Interventions, Exercise Therapy, Stroke Recovery, Assistive Technology and Chair," among others. We performed an extensive search on three well-known electronic databases. The bibliographic databases employed in this study are PubMed, Embase, Cochrane Library, EBSCO, Web of Science,

and CNKI. The search was conducted electronically on October 25th, 2023, and later updated on November 2, 2023, encompassing the time frame from 2015 to 2023. The paper mentioned in the technique is detailed in the reference.

Inclusion and exclusion criteria

The criteria for inclusion in this review encompassed the following aspects: (1) The target group comprised individuals who were 18 years or older. (2) The evaluated intervention was the use of chairs in stroke rehabilitation (3) wheelchair users use the chair in all activities of daily life. The study included quasi-experimental studies, comparative cross-sectional studies, case-control studies, cohort studies, qualitative investigations, and before-after studies.

Several eligibility criteria were employed to determine if individuals may be included in this study. (1) Excluded were interventions that were not related to chair; (2) Not considered were therapies that did not expressly focus on chair use in stroke therapy. (3) Interventions targeting cardiovascular illnesses other than stroke were also eliminated from consideration. (4) Studies that presented clinical and pharmacological trials were excluded from consideration. (5) Excluded from the analysis were systematic reviews, reviews, editorials, conference proceedings, commentary, opinions, case reports, and case series. Studies that specifically targeted individuals below the age of 18 were excluded from consideration. Studies authored in languages other than English were excluded from consideration.

Screening and data collection

The acquired articles underwent meticulous scrutiny and were selected based on certain criteria for inclusion. The entire paper was then acquired for a comprehensive and meticulous assessment. The data screening process was independently carried out by two reviewers. The articles were acquired by retrieving both their "title and abstract" and their "full text". The researcher effectively resolved disagreements with the software built by Rayyan QCRI, which was employed to screen papers based on their title and abstracts (Su et al., 2021). Furthermore, each excluded item in the analysis was accompanied by documented arguments for its exclusion. The literature has already considered an approach known as "prioritization and sequential exclusion". The process of selecting studies was visually depicted using the PRISMA flow diagram. The study employs Microsoft Excel to extract data from a standardized spreadsheet format, as referenced in [29], which includes coding. The intervention was devised and executed in two rigorous investigations.

Result

Search results

A comprehensive search was conducted across many databases including PubMed, Embase, Cochrane Library, EBSCO, Web of Science, and CNKI, resulting in a total of 1803 articles. Consequently, 58 papers that met the criteria for possible eligibility were discovered by analyzing their titles and abstracts. Out of the 58 articles that were reviewed, only 6 articles satisfied the inclusion criterion. Furthermore, 52 publications were removed due to the inclusion of patients without stroke or the absence of wheelchair utilization for stroke treatment. Additional studies were omitted due to the unavailability of the original data, which could not be obtained from either the paper or the author. Additional studies were eliminated due to their non-randomized controlled design or because their outcome was not relevant to the current analysis. Figure 1 illustrates the procedure for identifying the eligible articles.

Study characteristics

There were a total of 6 studies included in the study. All of these articles focused on investigating the effectiveness of wheelchair exercise for people who have had a stroke. All trials were published from 2015 to 2023. The comprehensive description can be observed in Table 1. All of the studies were conducted as single-center trials. Specifically, six studies utilized interventions such as Trunk Stability, Sit And Stand Independently, Sitting Posture and Trunk Control, Monkey Chair And Band System, Beach Chair Position, and Chair-Stand Exercise.

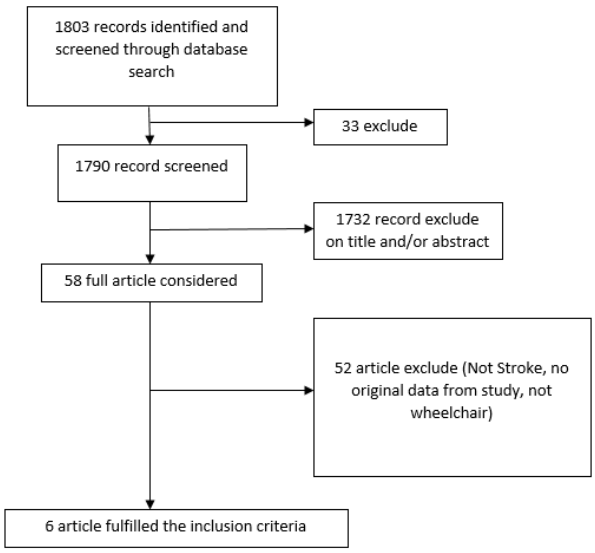

Figure 1. Flow chart of the study selection procedure

The results of this study concluded that physical activities that can be done by stroke patients who use wheelchairs are evaluating the effectiveness of trunk stabilization exercises using variations in chair height (50, 60, and 70 cm), independent sitting and standing exercises, as well as sitting position and trunk control in stroke patients. In addition, the use of the Monkey Chair and Band System as training aids has also been shown to be effective in improving trunk stability and control in stroke patients. The beach chair sitting position also provided additional benefits in maintaining good body position and improving body control. In this research, trunk stabilization exercises with variations in chair height, independent sitting and standing exercises, use

of the Monkey Chair and Band System, and beach chair sitting can be effective interventions to improve body control, stability, and independence of sitting and standing in stroke patients. This study provides important guidance for healthcare professionals in designing adequate rehabilitation programs for stroke patients.

Table 1.
Characteristics of Included Studies Article

Article, Year	Patients Characteristic	Intervention	Duration of trial period
Si-Eun Park, PT, PhD, and Sang-Hyun Moon, PT, MD, (2016). (Republic of Korea)	stroke patients.	Trunk Stability (chair heights (50, 60, and 70 cm))	5 times per week for 6 weeks
Katrine Lyders Johansen, Rikke Derby Stistrup, Camilla Skibdal Schjøtt, Jacqueline Madsen, Anders Vinther, (2016), (Denmark)	hospitalised stroke patients	Sit And Stand Independently	30 second Chair-Stand
Priscila Salge Mauad Rodriguesa , Marcos Massao Shimanob , Edimar de Oliveira, et al.., (2023), (Brazil)	acute stroke phase	Sitting Posture and Trunk Control	(30 min, twice a day, for three days)
Hyun-Ju Jeon, PhD, Sangjoon An, PhD, Jinwoo Yoo, No-Hyun Park, PhD, Kyu Hoon Lee, PhD. (2016), (Republic of Korea)	Patients had shoulder pain and limited shoulder movement	Monkey Chair And Band System,	four weeks for twelve weeks
Joost HJ. Van Erp, M. Ostendorf, J.R. Lansdaal.(2019), (Netherlands)	Perioperative stroke	Beach Chair Position	-
Yoshihiro Yoshimura, Hidetaka Wakabayashi, et all. (2022), (Japan)	post-stroke dysphagia	Chair-Stand Exercise	frequency of daily chair-stand exercise was independently

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Discussion

The primary objective of this study was to examine the impact of wheelchair exercise on enhancing the condition of stroke patients who have previously been diagnosed with stroke and are presently receiving rehabilitation. The investigation yielded two novel discoveries Trunk stability, independent sit-to-stand ability, proper sitting posture and control, utilization of the monkey chair and band system, adoption of the beach chair position, and engagement in chair-stand exercises.

The study found a significant correlation between the chair-stand exercise and the improvement of sarcopenia in stroke patients who had been diagnosed with sarcopenia.

A positive link was seen between the frequency of chair-stand exercise and a significant decrease in sarcopenia rates among patients(Misra et al., 2021). The chair-stand exercise demonstrates a significant correlation with the improvement of activities of daily living (ADL). The findings suggest that a defined number of chair stand exercise repetitions, together with engagement in a rehabilitation program lasting up to three hours per day, is a successful approach for enhancing activities of daily living (ADL) in these individuals(Eng & Reime, 2014). This practice entails transitioning from a seated posture in a chair to an upright stance. Its purpose is to optimize the general well-being and physical condition of those who have experienced a stroke and are facing physical restrictions(Lam et al., 2022). Furthermore, this specific activity does not require any specialized knowledge, equipment, or infrastructure, making it possible at a minimal cost. Furthermore, it can be pursued by both people and groups(Mewo & Chayati, 2021).

Recent systematic research suggests several barriers exist. Initially, this study was conducted exclusively in a solitary rehabilitation center in Japan, which may potentially restrict the applicability of the results. Further multicenter investigations are necessary to ascertain if comparable outcomes may be achieved in heterogeneous groups (Jeon et al., 2016). Furthermore, the retrospective nature of the study prevented us from acquiring comprehensive data regarding the impact of dysphagia rehabilitation quality and quantity, patients' physical endurance, and dietary therapy during hospitalization on functional results. Furthermore, the observational study design prevents the establishment of any causal association. In order to account for these variables, it is necessary to conduct rigorous prospective and interventional studies of superior quality in the future (Gangwani et al., 2022). There are several constraints associated with this study. Initially, the study primarily focused on the duration required to complete the 5STSt, without evaluating the quality of the movement. The cross-sectional study design precludes the establishment of causal links between the variables under investigation (Jordan et al., 2022). Furthermore, the assessment was limited to patients who had experienced a stroke and healthy individuals who were matched in terms of their characteristics(Maier et al., 2019). Therefore, the current findings can only be applied

to persons who possess clinical and demographic characteristics that closely resemble those of the population in this study. Ultimately, the seat height was standardized at 48 cm, deviating from the APTA clinical practice standards which indicate a range of 43-45 cm(S. J. Park & Oh, 2020). Furthermore, it should be noted that the standardized chair did not align the hip flexion angle to a 90-degree position while seated, as per the prescribed criteria. In the future, it will be required to make a direct comparison utilizing the APTA standard on height and hip position. In addition, the lack of standardization in foot position may lead to variations in the angle of knee flexion, thereby impacting the quadriceps torque. Further research should be conducted to include patients who have recently suffered a stroke, both in the acute and sub-acute phases. This would help to enhance the applicability of the current study's findings. Initially, this investigation was carried out exclusively at a solitary community-based rehabilitation hospital in Japan, thus constraining the applicability of the results. Future research should prioritize doing multicenter trials to validate whether comparable outcomes can be achieved across various groups(S. E. Park & Moon, 2016). Furthermore, sarcopenia was not diagnosed based on physical function. We determined that utilizing physical function assessment for sarcopenia diagnosis was unsuitable due to the physical limitations resulting from the stroke itself. This could potentially impact the precision of sarcopenia diagnosis. Furthermore, due to the retrospective nature of the study, we encountered limitations in acquiring comprehensive data regarding the impact of rehabilitation and nutrition therapy on the outcomes during hospitalization. Future research should prioritize doing rigorous, prospective, and interventional studies that account for these confounding factors(Lee et al., 2022).

This study emphasizes the significance of using the MorGen as a tool to test linguistic abilities after a stroke. The MorGen is particularly useful since it captures skills that are not fully assessed by commonly used evaluations like the WAB and BNT(Duncan et al., 1994). According to our hospital's data, we believe that the incidence of stroke during shoulder surgery, namely in the perioperative period, is more than what has been previously published(Hodson et al., 2016). Surgeons must be cognizant of this potential hazard while employing the beach chair position. 1) Due to ethical concerns, alternative therapies for shoulder discomfort such as acupuncture, oral medicines, electrotherapy, and joint cavity injections were not included in the study as controlled variables. 2) The physical therapy and exercises provided in the usual rehabilitation therapy varied for patients in the control group due to the implementation of personalized treatment programs for each individual. 3) The results cannot be extrapolated due to the inadequate sample size and research duration. 4) The study excluded patients who were unable to bend and move the shoulder more than 90°, and extend and bring the shoulder closer to the body by more than 20°(Kwakkel et al., 2002). The assessment of patients' self-efficacy and professional satisfaction was not conducted. The exclusion of the outlier in this study serves as an illustration of the range of physical and cognitive abilities observed among stroke patients in clinical settings(Smith et al., 2017). This study had a small sample size and lacked a control group. Hence, it is imperative to conduct future studies with a more extensive sample size. The authors anticipate that the outcomes of this study may encourage the utilization of various therapeutic approaches employing Proprioceptive Neuromuscular Facilitation (PNF) techniques in the management of stroke patients.

Limitation

Nevertheless, this systematic review is not without its constraints. To commence, this systematic review did not incorporate any research reports of superior quality. As per the Cochrane Collaboration's recommendations, the quality of the nine articles comprising this systematic review was substandard, thereby introducing a significant potential for bias. Second, as a consequence of inaccurate and inconsistent outcomes. The lack of differentiation between primary and secondary outcomes introduces a greater potential for fortuitous discoveries, owing to the extensive utilization of selective testing and reporting. Thirdly, an excessive number of inconsistent indices, particularly for the locomotion variable, were utilized to generate the forest plots. Therefore, the forest sections utilized exclusively the BBS. Furthermore, it was deemed unsuitable to utilize additional indices, including the walking time score, FM-B balance subscale, and functional walking scale, on a complete forest tract. As a result, declarative descriptions were selected. The likelihood of publication bias constitutes the fourth constraint. The potential for publication bias has been mitigated by conducting exhaustive database searches. Nevertheless, no search was conducted for unpublished articles. We may have thus overlooked some crucial data.

Research implications

When compared to other types of physical activity, engaging in wheelchair-based training may yield greater short-term improvements in gait and balance for stroke patients. However, it is important to note that this review only considered short-term effects. Furthermore, it is crucial to consider additional factors pertaining to wheelchair exercise for stroke patients, such as the frequency of falls, the impact on their overall well-being, and their cognitive abilities. Nevertheless, these effects were derived from certain instances of substandard data, and further explicit papers are required to validate these outcomes.

Conclusion

According to our findings, we propose the following

suggestions. The study's good results demonstrate that wheelchair exercise has a favorable impact and can enhance the capabilities of those who have had a stroke. Wheelchair users exhibit diverse actions to enhance their functional capabilities. Nevertheless, inferences are made relying on significant diversity, necessitating higher quality data and bigger sample sizes. For optimal wheelchair training of stroke patients, it is recommended to utilize standardized and universally accepted gait outcomes in the future. It is crucial to gather data in a methodical manner for the purpose of tracking progress across short, medium, and long periods of time.

Acknowledgments

The authors express their gratitude to the healthcare professionals who actively engaged in the discussions and generously shared their valuable insights. Thanks all of participants for their collaboration and Institute of Research Universitas Negeri Malang, Universitas Negeri Padang and Universitas Andalas. This research was supported by Deanship of Scientific Research, KSU, Riyadh, Saudi Arabia.

Conflicts of Interest

None declared.

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