Research Article

The Effectiveness of Telerehabilitation in Improving Balance Control Among Older Adults: A Systematic Review & Meta Analyses

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Objectives. The aim of this review is to synthesize existing literature that used telerehabilitation services as an intervention to improve balance control among the older adult.
Methodology. A literature search was performed in five electronic databases from their inception to February 2024. The initial search was conducted in December 2023 by five reviewers and was further updated by two more reviewers in February 2024. Search terms relating to older adults, telerehabilitation, and balance control were used. All peer-reviewed articles meeting the following criteria were considered for inclusion: randomized control study design with individuals aged 60 and above who underwent telerehabilitation and assessed with static and dynamic balance outcomes. Two reviewers assessed the quality of studies using the revised JBI Checklist for Randomized Controlled Trials. Data were extracted such as participant's characteristics, intervention protocol, outcome measures, and significant finding. The protocol for this review was registered in Prospero in February 2024 (https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42024517316)

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1. Introduction

Postural balance is defined as the ability of an individual to maintain their center of gravity within their base of support [1] Furthermore, balance control is the act of maintaining a certain posture amidst any form of external and internal disturbances, and is dependent on motor, sensory, visual, cognitive, and vestibular networks [2]. This control inevitably declines with age due to the physiologic changes undergone in the human body. In older adults, primarily those 60 years old and above, studies have named poor balance as one of the most common risk factors for falls, with the same population having the highest risk of severe injury or death from falls [3] Hence, interventions that address this problem must be further explored and studied.

The current treatments provided that have been proven to be effective include resistance training, aerobic exercise, balance training, & multi-component exercise training. Specific tools such as wobble boards, vestibular balls, and exergaming technology are also heavily mentioned in the context of balance rehabilitation [4][5]. However, during the Coronavirus pandemic, all these interventions were challenged and modified into a form of virtual rehabilitation setting. Studies have been conducted regarding the effectiveness of telerehabilitation in improving balance but have shown inconsistent results.

It is crucial that we identify the effectiveness of telerehabilitation in improving the balance control of older adults and the factors that contribute to specific outcomes as to ensure the increase of balance control and prevention of falls in the older population despite the limitations of the online setting. This study aims to systematically review articles that explore this topic in order to determine the success of balance training in telerehabilitation and the factors that contributed to it.

Review Question

What is the effectiveness of telerehabilitation in improving the balance control of older adults?

Inclusion Criteria

Participants

This systematic review will include studies that involve the older adult population aged 60 years old and above who may or may not present with health conditions (e.g. healthy older adults,

cardiovascular disease patients, stroke patients).

Intervention(s)

This systematic review will include randomized controlled trials that utilized telerehabilitation as its primary intervention.

Comparator

This systematic review will include studies that compare telerehabilitation to standard care or conventional physical therapy management and placebo for balance control among older adults.

Outcomes

This systematic review will consider studies that include balance control and functional balance as its primary outcome and fall risk and fear of falling as its secondary outcome. Balance can be divided into can be divided into two types: static which is defined as the ability to maintain an upright posture and to keep the line of gravity within the limits of the base of support and dynamic balance which is defined as the ability to maintain stability during weight shifting, often while changing the base of support [6]. The studies collected used outcome measure tools such as the Berg Balance Scale [7][8][9] and Mini BESTest [7] for balance control. Meanwhile, functional balance outcomes were Timed Up and Go Test [10][11][12][13][14], Functional Independence Measure [10], Barthel Index [15], Timed Sit to Stand Test [14], Functional Reach Test [12], POMA-G [16] and Six Meter Walk Test [17]. Secondary outcome measures included psychological and physiological measures to balance control. Included in these secondary outcomes were Fall Risk Assessment tools, Short Physical Performance Battery [14][18], STEADI Fall Risk Test [19], Falls Efficacy Test [8][20][21], and self-reported surveys and questionnaires from the studies were also included.

Types of Studies

This systematic review will include randomized controlled trials that are fully accessible without charge, peer-reviewed, and published in the English language.

2. Methods

The proposed systematic review will be conducted following the methodology of JBI Evidences for systematic review and effectiveness. This review will be registered in PROSPERO, an online database that compiles systematic review protocols.

Search Strategy

A comprehensive electronic search will be undertaken to retrieve studies that explore the role of telerehabilitation in enhancing balance control among older adults from inception until November 2023 in the following 4 databases: PubMed, Science Direct, Cochrane, and Google Scholar. The initial search will be conducted on November 2023 by two of the reviewers (CC & SH) and will be further updated and reviewed by three more reviewers (BE, CN, RR). Search terms will consist of appropriate key words relating to older adults, telerehabilitation, and balance control. The search strategy used will be placed in the Appendices.

The process of retrieving articles will be based on the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines. The search will be executed by two reviewers (CC & SH) and will be placed in Google Sheets. Screening of article titles and removal of duplicates will be performed by two reviewers (CN & RR). The screening of abstracts will be performed by two other reviewers (BE & KR). Full-text screening and double-checking for duplicates will be performed by three reviewers (MB, CG, ASM). Any uncertainties with inclusion of an article will be settled by one reviewer (SH) to reach consensus.

Eligibility Criteria

Studies written in the English language utilizing telerehabilitation as an intervention will be included, along with studies that involve a population of older adults aged 60 years old and above with or without a health condition. Studies that include balance exercises and outcome measures that measure both static and dynamic balance will be part of the systematic review. Unpublished studies written in a foreign language and have no full-text access will be excluded from this review.

Outcome Measures

Data extracted from the studies will include post-intervention outcome measure effects; these effects include the following:

1. Primary Outcome Measures: Balance Control and Functional Balance
    1. Balance can be divided into can be divided into two types: static which is defined as the ability to maintain an upright posture and to keep the line of gravity within the limits of the base of support and dynamic balance which is defined as the ability to maintain stability during weight shifting, often while changing the base of support [6]. The studies collected used outcome measure tools such as the Berg Balance Scale [7][8][9] and Mini BESTest [7] for balance control. Meanwhile, functional balance outcomes were Timed Up and Go Test [10][11][12][13][14], Functional Independence Measure [10], Barthel Index [15], Timed Sit to Stand Test [14], Functional Reach Test [12], POMA-G [16] and Six Meter Walk Test [17].
2. Secondary Outcome Measures: Physiological and Psychological Measures to Balance Control
    1. Secondary outcome measures included psychological and physiological measures to balance control. Included in these secondary outcomes were Fall Risk Assessment tools, Short Physical Performance Battery [14][18], STEADI Fall Risk Test [19], Falls Efficacy Test [8][20][21], and self-reported surveys and questionnaires from the studies were also included.

Assessment of Risk of Bias

Included articles will be screened for internal validity through the revised JBI Critical Appraisal Tool for Assessment of Risk of Bias for Randomized Controlled Trials. Articles were marked with “yes”, “no”, or “unclear” if details provided were inadequate to provide a definite answer. Authors of the articles will not be contacted for clarification of details. Two reviewers (BE & RR) will complete the risk of bias assessment for all included articles. A third reviewer (CC) will compare the two reviewers’ appraisals and finalize any discrepancies in the assessments.

Data Extraction and Synthesis

Data from studies included in the review will be manually extracted independently by nine reviewers using a data extraction table. The template used for the table will be derived from a previously done systematic review. Key information, such as the authors, year of publication, study's sample, intervention details, outcome measures, significant findings, and relevant statistical data, will be recorded in the table

Data Synthesis and Analysis

Meta-analysis will be conducted with Comprehensive Meta-Analysis software using random effects model for primary and secondary outcome measure tools. The random effects model will be utilized given the heterogeneity of the population and the range of interventions being evaluated [22]. Measure of homogeneity will be calculated using I^2 statistics to find out how much of the total variation is caused by between-study differences. Moreover, the researchers will use a forest plot to look for evidence of homogeneity among studies . Meanwhile, the Narrative Summary synthesis method will be used for quantitative data where pooling is not possible.

Extracted qualitative data will be synthesized using thematic analysis. Thematic analysis is a process of identifying common patterns, themes, or trends, creating codes for each category, and analyzing and interpreting data across qualitative studies [23]. Thematic analysis shall be employed using the Nvivo software. Framework matrices shall be created to compare and synthesize data across different themes or concepts. Generation of charts and illustrations shall ensure to better illustrate the findings where it is appropriate.

To assess the certainty in the findings, the Grading of Recommendations, Assessment, Development, and evaluation (GRADE) approach will be utilized [24].

Statements and Declarations

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This review fulfills the requirements of the Bachelor of Science in Physical Therapy program at the University of Santo Tomas, Sampaloc, Manila. It contributes to the degree of Mykhaela Jayne V. Bacanto, Charlize Lourdes S. Calinisan, Boris Y. Esperancilla, Carlo Benjamin F. Go, Sabrina E. Halili, Charlize Maria Hyacinthe R. Nabo, Renzo Raphael D. Raquepo, Kristiana Alexin E. Ruiz, and Alyssa Irene S. San Miguel.

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Conflicts of Interest

Two of the faculty co-authors, Prof. Donald S. Lipardo and Asst. Prof. Donald G. Manlapaz, are members of the Editorial Board of the Philippine Journal of Physical Therapy. All other authors declare no competing interests.

Notes

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by

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Declarations

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