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Effects of Proprioceptive Neuromuscular Facilitation on Balance, Gait Speed Performance, and Functional Mobility in Patients with Stroke: A Systematic Review and Meta-analysis of Randomized Controlled Trials

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ADMINISTRATIVE INFORMATION**Support** - None.**Review Stage at time of this submission** - Completed but not published.**Conflicts of interest** - None declared.**INPLASY registration number:** INPLASY202670075

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 19 July 2026 and was last updated on 19 July 2026.

INTRODUCTION

Review question / Objective This systematic review and meta-analysis of randomized controlled trials evaluated the effects of proprioceptive neuromuscular facilitation (PNF) on gait speed, balance, and functional mobility after stroke and explored potential moderators through subgroup and meta-regression analyses.

Rationale Stroke is a major neurological disorder that commonly results in motor and sensory impairments, contributing to deficits in balance, gait, and functional mobility. These impairments increase the risk of falls and may further reduce independence and quality of life after stroke. Physical therapy therefore plays an important role in improving mobility and reducing fall risk in stroke rehabilitation. PNF is a widely used rehabilitation approach that facilitates neuromuscular control through proprioceptive and exteroceptive inputs, including manual resistance, stretch, verbal and

visual cues, and diagonal and spiral movement patterns. PNF can be applied to different body regions and has also been incorporated into taping techniques based on PNF movement patterns. Although previous meta-analyses have examined the effects of PNF after stroke, the influence of different PNF application strategies and clinical characteristics remains unclear. Therefore, this systematic review and meta-analysis of randomized controlled trials evaluated the effects of PNF on gait speed, balance, and functional mobility after stroke and explored potential moderators through subgroup and meta-regression analyses.

Condition being studied This meta-analysis will be conducted using the PICO framework as follows:

Population (P): diagnosis of stroke; Intervention (I): PNF; Comparison (C): the control group who did not undergo PNF; Outcomes (O): gait speed performance, functional mobility and functional balance.

METHODS

Participant or population Stroke.

Intervention PNF.

Comparator Other conventional physical therapies.

Study designs to be included Randomized controlled trials.

Eligibility criteria The inclusion criteria will be as follows: (1) randomized controlled trials; (2) adult participants with strokes; (3) intervention groups involving PNF, either as a standalone intervention or combined with other therapeutic approaches; and (4) inclusion of at least one comparator group not receiving PNF.

Information sources The literature search will use terms related to PNF ("proprioceptive neuromuscular facilitation," "PNF," "PNF therapy," "PNF technique," "PNF training," and "PNF exercise") in combination with stroke-related keywords ("stroke," "cerebrovascular accident," "cerebral infarction," and "brain infarction"). Search terms were combined using appropriate Boolean operators, with database-specific syntax and indexing terms applied as required.

Main outcome(s) The primary outcome will be gait speed performance, which will be assessed using the GAITRite system or the 10-meter walk test(10MWT).

Additional outcome(s) The secondary outcomes will include functional balance, assessed using the Berg Balance Scale, and functional mobility, assessed using the Timed Up and Go test.

Data management Two reviewers will independently collect relevant information from all eligible studies, including publication characteristics, sample size, participant demographics, study design, intervention details, outcome assessments, and follow-up periods. Any unclear or missing information will be addressed by contacting the corresponding study authors to request clarification or additional data when necessary. For studies reporting outcomes at multiple follow-up time points, data obtained immediately after completion of the intervention will be used for the analysis.

Quality assessment / Risk of bias analysis The methodological quality of the included studies will be evaluated using the Physiotherapy Evidence

Database (PEDro) scale, with total scores ranging from 0 to 10 and higher scores reflecting greater methodological quality.

Strategy of data synthesis Given the anticipated clinical heterogeneity across studies, meta-analyses will be conducted using a random-effects model in Comprehensive Meta-Analysis software (version 4; Biostat, USA). Effect estimates will be reported as Hedges' g , with values of approximately 0.2, 0.5, and 0.8 interpreted as small, moderate, and large effects, respectively. Statistical heterogeneity will be examined using Cochran's Q test and the I^2 statistic, with I^2 values of 25%, 50%, and 75% indicating low, moderate, and high heterogeneity, respectively. A two-tailed p value < 0.05 will be considered statistically significant. Subgroup analyses will examine differences according to PNF facilitation strategy (conventional PNF techniques vs. PNF pattern-based taping) and extremity pattern inclusion (with vs. without upper and/or lower extremity patterns), assuming a common between-study variance (τ^2) across subgroups. Meta-regression analyses will assess the potential influence of treatment duration, treatment frequency, age, BMI, and predominant stroke subtype on treatment effects.

Subgroup analysis Subgroup analyses will examine differences according to PNF facilitation strategy (conventional PNF techniques vs. PNF pattern-based taping) and extremity pattern inclusion (with vs. without upper and/or lower extremity patterns), assuming a common between-study variance (τ^2) across subgroups. Meta-regression analyses will assess the potential influence of treatment duration, treatment frequency, age, BMI, and predominant stroke subtype on treatment effects.

Sensitivity analysis Sensitivity analyses will be conducted using a leave-one-out approach to assess the robustness of the pooled effect estimates.

Language restriction No language limit.

Country(ies) involved Taiwan, R.O.C.

Keywords Proprioceptive Neuromuscular Facilitation, Thrombotic Stroke, Ischemic Stroke, Stroke Rehabilitation.

Contributions of each author

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