

INPLASY2025100076
doi: 10.37766/inplasy2025.10.0076
Received: 21 October 2025
Published: 21 October 2025

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Effectiveness of Mulligan Concept Mobilization on Pain and Disability Outcomes in Cervical Radiculopathy: A Systematic Review with Subgroup Meta-Analysis and Meta-Regression of Randomized Controlled Trials

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ADMINISTRATIVE INFORMATION

Support - Non.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY2025100076

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 21 October 2025 and was last updated on 21 October 2025.

INTRODUCTION

Review question / Objective To investigate the effectiveness of Mulligan Concept Mobilization in alleviating pain and improving disability among individuals with cervical radiculopathy, with additional subgroup and meta-regression analyses conducted to examine potential moderators influencing treatment effects.

Rationale Cervical radiculopathy affects approximately 107.3 per 100,000 men and 63.5 per 100,000 women each year, with the highest prevalence among individuals over 40 years of age. It commonly arises from cervical disc herniation or spondylosis, leading to compression and inflammation of the cervical nerve roots. Clinical symptoms include neck pain radiating to the arm, sensory and motor impairments, and decreased reflexes, which can be identified through clinical tests, imaging, and electrophysiological assessments. Physical

therapy is a primary conservative approach, incorporating traction, exercise, and manual therapy. The Mulligan Concept Mobilization, including sustained natural apophyseal glides, natural apophyseal glides, traction, and spinal mobilization with arm movement, involves applying a manual glide to a joint while the patient performs an active movement. Despite its clinical use, evidence from randomized controlled trials remains inconsistent. Therefore, this systematic review and meta-analysis aim to determine its overall effectiveness for cervical radiculopathy and to identify.

Condition being studied This meta-analysis was structured based on the PICO framework, in which the population consisted of individuals with cervical radiculopathy, the intervention was Mulligan Concept Mobilization, the comparison involved control groups that did not receive Mulligan Concept Mobilization, and the outcomes focused on reductions in pain intensity and disability.

METHODS

Search strategy The electronic searches in the PubMed, ClinicalTrials.gov, Medline-Ovid, and the Physiotherapy Evidence Database (PEDro) with keyword of “Mulligan concept mobilization” OR “sustained natural apophyseal glides” OR “natural apophyseal glides” OR “Mulligan cervical traction” OR “spinal mobilization with arm movement”) AND (“cervical radiculopathy” OR “cervical spondylosis” OR “cervical disc herniation”) through the earliest record to October 2025.

Participant or population Cervical radiculopathy.

Intervention Mulligan Concept Mobilization.

Comparator Conventional physical therapy programs or nerve mobilization therapies.

Study designs to be included Randomized controlled trials.

Eligibility criteria The inclusion criteria were as follows: (1) RCTs investigating changes in pain intensity and/or disability before and after mulligan concept mobilization; (2) studies enrolling adults (≥ 18 years) diagnosed with cervical radiculopathy based on the imaging or provocative tests ; (3) intervention groups performing mulligan concept mobilization alone or in combination with conventional physical therapies (CPT) (e.g., neck strengthening or stretching exercise or physical agents); and (4) at least one control group receiving treatments that did not include any form of Mulligan Concept Mobilization.

Information sources A comprehensive literature search was conducted in PubMed, ClinicalTrials.gov, Medline-Ovid, and the Physiotherapy Evidence Database (PEDro) using the following keywords: “Mulligan Concept Mobilization” OR “sustained natural apophyseal glides” OR “natural apophyseal glides” OR “Mulligan cervical traction” OR “spinal mobilization with arm movement” AND “cervical radiculopathy” OR “cervical spondylosis” OR “cervical disc herniation.”

Main outcome(s) Pain intensity, the primary outcome, was assessed pre- and post-intervention using the Visual Analogue Scale or the Numeric Pain Rating Scale.

Additional outcome(s) The secondary outcome was functional improvement measured by the Neck Disability Index and the Northwick Park Neck Pain Questionnaire, both validated tools assessing neck

pain-related disability, with higher scores indicating greater functional limitation.

Data management Data extraction was performed by the first author, who collected information on publication year, author, sample size, demographics, study design, intervention details, outcome measures, and assessment time points. Reasons for study exclusion were recorded. For studies with multiple follow-up periods, only the end-of-intervention data will be included in the analysis.

Quality assessment / Risk of bias analysis The methodological quality of the included randomized controlled trials were assessed using the Physiotherapy Evidence Database (PEDro) scale, which consists of 11 items evaluating internal validity and statistical reporting. Since Item 1, addressing external validity, is not scored, the total score ranges from 0 to 10, with higher values indicating better methodological quality. Each study was independently appraised by one reviewer. According to the classification proposed by Cashin and McAuley (2020), scores of ≤ 3 indicate poor quality, 4–5 fair quality, 6–8 good quality, and 9–10 excellent quality.

Strategy of data synthesis Given the anticipated variability in treatment protocols, a random-effects model was employed for data synthesis using Comprehensive Meta-Analysis software (version 4; Biostat, Englewood, NJ, USA). Statistical significance will be set at $p < 0.05$ (two-tailed). Effect sizes will be calculated as Hedges' g and interpreted as small (0.2), moderate (0.5), and large (0.8). Between-study heterogeneity was examined using Cochran's Q and the I^2 statistic, with I^2 values of 25%, 50%, and 75% indicating low, moderate, and high heterogeneity, respectively.

Subgroup analysis Subgroup analyses were conducted based on treatment protocols and control types, classifying interventions into spinal mobilization with arm movement and sustained or natural apophyseal glide groups. When spinal and neural mobilizations are applied simultaneously, they are also defined as spinal mobilization with arm movement. Meta-regression will examine associations between treatment effects and factors such as duration, age, and gender ratio. Publication bias will be assessed using funnel plots and Egger's test following Cochrane guidelines.

Sensitivity analysis Sensitivity analysis was not conducted.

Language restriction No language limit.

Country(ies) involved Taiwan.

Keywords cervical radiculopathy, manual therapy, meta-analysis, mobilization with movement.

Contributions of each author

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