

Effects of Tempo-Controlled Resistance Training on Corticospinal Tract Plasticity in Healthy Controls: A Systematic Review

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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: INPLASY202460121

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 30 June 2024 and was last updated on 30 June 2024.

INTRODUCTION

Review question / Objective The purpose of the current systematic review was to identify the effects of TCRT on corticospinal plasticity in healthy adults. A secondary outcome of this review was to determine the short-term effects of strength after TCRT. The findings will contribute to the growing body of evidence supporting the integration of TCRT as a potentially effective strategy for modulating neural adaptations within the corticospinal tract and primary motor cortex.

Rationale By enhancing our understanding of these effects, this research may pave the way for optimized exercise interventions that promote neuroplasticity and ultimately improve motor function in both healthy individuals and clinical populations alike.

Condition being studied Tempo-based resistance training in healthy adults.

METHODS

Search strategy The search strategy was generated using Zotero and was audited by a medical school librarian to ensure the appropriate use of Boolean modifiers, accurate translation of the search strategy across databases, and the appropriateness of the search based on the study's stated purpose. The keywords used were variations and derivatives of the following: "[corticospinal plasticity]," "[tempo-controlled strength training]," and "[metronome paced strength training]."

Participant or population Healthy Adults, aged 18-40 years old.

Intervention Tempo-Controlled Resistance Training.

Comparator Other conservative treatment, self-paced strength training.

Study designs to be included RCT.

Eligibility criteria

- subjects must be free of any known neurological disorders
- non-standardized or controlled tempo of resistance training within interventions of the studies
- no prior surgeries to the body region being trained in the study
- full-text must be unattainable
- there must be a quantifiable measurement of corticospinal excitability and inhibition
- Randomized control trials only
- English language
- Human subjects.

Information sources PubMed, CINAHL, Embase, and Google Scholar.

Main outcome(s) Corticospinal Plasticity via excitability, inhibition, or both.

Data management The initial search results of the different databases were combined, duplicates deleted, and filtered independently according to the specified inclusion and exclusion criteria using a citation manager, Zotero, and a systematic review software management system, COVidence (Veritas Health Innovation, Melbourne, Australia). Figure 1 outlines the study selection process in a PRISMA flow diagram.

Quality assessment / Risk of bias analysis

Consistent with the Cochrane Handbook, the risk of bias (RoB) and quality appraisal of the included RCTs were assessed [29]. The RoB assessment of the included studies was performed using the PEDro scale which is summarized in Table 2. All the RCTs were deemed to be “good” with a low risk of bias.

Strategy of data synthesis Data elements of identified full-text articles were prospectively determined based on the PICO question and the purpose of the current study. For each study, data extraction was based on the following characteristics: (1) last name of author and year of publication, (2) study design, (3) sample size, (4) intervention, (5) subject demographics, (6) outcomes, (7) exclusion criteria, and (8) methods.

Please refer to Figure 1 for a summary of study characteristics and Table 2 for study qualifiers.

The level of evidence for all included studies was assessed according to criteria adapted from the Centre for Evidence-Based Medicine, Oxford, United Kingdom [28]. The OCEBM tool utilizes study design, randomization, blinding, and the quantity of bias to grade studies on a scale from I–V, with I being the highest level of evidence. A summary of the OCEBM criteria for each level of evidence is provided in Appendix B.

Subgroup analysis No subgroup analysis was performed.

Sensitivity analysis No sensitivity analysis was performed.

Language restriction English.

Country(ies) involved United States.

Keywords corticospinal excitability; intra-cortical inhibition; primary motor cortex; skill training; strength training; metronome-paced strength.

Dissemination plans 1. Accepted for publication in "Healthcare" by MDPI 2. Accepted Poster Presentation at State Annual Conference 2024.

Contributions of each author

Author 1 - Talia Gordon - Lead project and author. Performed 90% of the work for this project. Including the search strategy development, initial idea, inclusion and exclusion criteria, writing of the paper.

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Author 2 - Michael Jeanfavre - provided guidance in the project execution. provided edits and assisted with figure & table creation.

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Author 3 - Gretchen Leff - Senior Author. Provided guidance, editing, and recommendation on systematic review execution and manuscript completion.

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