

Effects of Physical Therapy Modalities on Elastography-Measured Stiffness of Muscle-Tendon Properties: A systematic review of randomised controlled trials with meta-analyses

INPLASY202470062

doi: 10.37766/inplasy2024.7.0062

Received: 15 July 2024

Published: 15 July 2024

Yagiz, G; Yanase, K; Umehara J.

Corresponding author:

Gokhan Yagiz

yagizg23@ecu.edu

Author Affiliation:

East Carolina University.

ADMINISTRATIVE INFORMATION

Support - This systematic review has received no specific funding.

Review Stage at time of this submission - Formal screening of search results against eligibility criteria.

Conflicts of interest - None declared.

INPLASY registration number: INPLASY202470062

Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 15 July 2024 and was last updated on 15 July 2024.

INTRODUCTION

Review question / Objective The central question guiding this review is: What are the specific effects of physical therapy modalities on the stiffness of the human skeletal muscles, as measured by elastography assessments in randomised controlled trials (RCTs)? This question serves as the foundation for our systematic review and meta-analysis, providing a direction for our research and the information we aim to uncover.

Rationale The stiffness of the muscles and tendons are essential factors affecting human movement. It might change due to certain conditions, comprising, but not restricted to, ageing, diseases, musculoskeletal injuries, and training or disuse. Historically, elastography measurements have examined liver diseases,

cancer types, and thyroids. With recent improvements, elastography measurements have started to be used for musculoskeletal applications. In this way, examining the stiffness of specific areas of individual muscles and tendons has become possible. Elastography usage for stiffness assessments of the muscles or tendons differs from conventional techniques that do not allow the measurement of muscles or tendons individually. There is no comprehensive systematic review screening the effects of physical therapy modalities on elastography-quantified stiffness of skeletal muscle and tendon properties in the literature. Therefore, this systematic review and meta-analysis aims to screen randomised controlled studies reporting physical therapy modality-stimulated alterations in elastography-quantified stiffness of individual muscles and tendons (e.g. ultrasound shear wave elastography and magnetic resonance elastography) in humans.

Condition being studied Effects of physical therapy on human skeletal muscle and tendon stiffness.

METHODS

Search strategy On June 18, 2024, Cochrane Library (Central) (905 articles), and the ProQuest Central databases (603) PubMed (158 articles) were detected using a combination of the following key terms: "Exercise"[Mesh], "Physical Therapy Modalities"[Mesh], "Rehabilitation" [Mesh], Acupressure, Acupuncture, Aquatic, Bandag*, Drainage, "Dry Needling", "Electric Stimulation", "Electrical Stimulation", Electroacupuncture, Electrostimulation, Electrotherapy, Exercis*, Hydrotherapy, Massage, Manipulation, Mobilisation, Mobilization, Myofascial, NMES, Osteopath*, "Percutaneous Collagen Induction", "Physical Therapy", Physiotherap*, Rehab*, Stretching*, Shockwave, "Tai Ji", Therap*, Training*, Yoga, Elastogra*, Sonoelastogra*.

As a result of the database searches, 1666 citations were retrieved. However, 251 duplicate records were detected and removed by EndNote X21 software. In conclusion, 1415 records imported to Rayyan software (Rayyan.ai, a web and mobile app for systematic reviews) for being reviewed by three authors of this systematic review in a blinded status.

Participant or population Humans.

Intervention Physical Therapy Modalities.

Comparator A non-training control, sham-control or placebo group.

Study designs to be included Randomised controlled trials.

Eligibility criteria Inclusion criteria are as follows: a) Being an RCT including a control or placebo group, b) applying clearly defined sole physical therapy modalities as an intervention, c) being conducted at least for four weeks of duration, d) having elastography-quantified muscle or tendon stiffness as an outcome, and e) being conducted on humans.

Information sources PubMed, ProQuest, Cochrane Library and reference lists of included studies.

Main outcome(s) Elastography-quantified stiffness of human skeletal muscles and tendons.

Data management The reviewers will perform data extraction in a blinded status. EndNote X21, Microsoft Excel and Word RevMan, and GRADEPro GDT software will be used during data extraction and analysis.

Quality assessment / Risk of bias analysis Cochrane Collaboration's risk of bias assessment tool for parallel group RCTs will be used to classify individual risk of bias in each included study. In the case of quantitative data synthesis, the overall evidence level will be classified using the GRADE approach (the Grading of Recommendations Assessment, Development and Evaluation).

Strategy of data synthesis The Review Manager (RevMan) of the Cochrane Collaboration or the Comprehensive Meta-analysis software will be used to perform the possible meta-analyses. The GRADEpro GDT software will be employed to classify the level of the body of evidence.

Subgroup analysis Subgroup analyses will be performed based on the population, intervention, and outcome differences or across the risk of bias tables in the case of high heterogeneity.

Sensitivity analysis If a meta-analysis shows a high heterogeneity between studies, a sensitivity analysis will be performed according to methodological features.

Language restriction English.

Country(ies) involved Japan; United States of America; Republic of Turkey.

Keywords Stiffness; elasticity; elastography; hardness; tenderness; muscle structure; tendon structure; elastogram; shear modulus.

Contributions of each author

Author 1 - Gokhan Yagiz - Reviewer and author.

Email: agizg23@ecu.edu

Author 2 - Ko Yanase - Reviewer and author.

Email: kyanase@mail.doshisha.ac.jp

Author 3 - Jun Umehara - Reviewer and author.