**Article Full Title**

Manual therapy directed at the knee or lumbopelvic region does not influence quadriceps spinal reflex excitability

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**Paper Abstract**

Manual therapies, directed to the knee and lumbopelvic region, have demonstrated the ability to improve neuromuscular quadriceps function in individuals with knee pathology. It remains unknown if manual therapies may alter impaired spinal reflex excitability, thus identifying a potential mechanism in which manual therapy may improve neuromuscular function following knee injury. Aim: To determine the effect of local and distant mobilisation/manipulation interventions on quadriceps spinal reflex excitability. Methods: Seventy-five individuals with a history of knee joint injury and current quadriceps inhibition volunteered for this study. Participants were randomised to one of five intervention groups: lumbopelvic manipulation (grade V), lumbopelvic manipulation positioning (no thrust), grade IV patellar mobilisation, grade I patellar mobilisation, and control (no treatment). Changes in spinal reflex excitability were quantified by assessing the Hoffmann reflex (H-reflex), presynaptic, and postsynaptic excitability. A hierarchical linear-mixed model for repeated measures was performed to compare changes in outcome variables between groups over time (pre, post 0, 30, 60, 90 min). Results: There were no significant differences in H-reflex, presynaptic, or postsynaptic excitability between groups across time. Conclusions: Manual therapies directed to the knee or lumbopelvic region did not acutely change quadriceps spinal reflex excitability. Although manual therapies may improve impairments and functional outcomes the underlying mechanism does not appear to be related to changes in spinal reflex excitability.

**NIH Risk of Bias Tool**

Quality Assessment of Controlled Intervention Studies

1. **Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT**

Yes

1. **Was the method of randomization adequate (i.e., use of randomly generated assignment)?**

Yes

1. **Was the treatment allocation concealed (so that assignments could not be predicted)?**

Yes

1. **Were study participants and providers blinded to treatment group assignment?**

No

1. **Were the people assessing the outcomes blinded to the participants' group assignments?**

Yes

1. **Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)?**

Yes

1. **Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment?**

Yes

1. **Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower?**

Yes

1. **Was there high adherence to the intervention protocols for each treatment group?**

Yes

1. **Were other interventions avoided or similar in the groups (e.g., similar background treatments)?**

Yes

1. **Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants?**

Yes

1. **Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power?**

Yes

1. **Were outcomes reported or subgroups analyzed prespecified (i.e., identified before analyses were conducted)?**

Yes

1. **Were all randomized participants analyzed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis?**

Yes

**Key Finding #1**

There were no differences in H-reflex, presynaptic, or postsynaptic excitability between lumbopelvic joint manipulation (Grade V), lumbopelvic manipulation positioning (no thrust), medial patellar mobilization (Grade IV and Grade I), and control groups at 0, 30, 60, and 90-minutes post-intervention.

**Key Finding #2**

Included participants had knee joint injuries with quadriceps inhibition due to knee osteoarthritis (grades IeII), patellofemoral joint pain, or participants who have undergone arthroscopic surgery for anterior cruciate ligament reconstruction, meniscotomy, plica removal, or debridement.

**Key Finding #3**

There were several limitations acknowledged in this study including 1) short duration of mobilization interventions (two minutes of medial patellar mobilization at one oscillation per second) compared to other studies, 2) participants not currently seeking medical care for knee pain, 3) joint mobility was not assessed prior to or after the intervention, and 4) pain and function were not assessed (mechanistic focus).

**Key Finding #4**

**Please provide your summary of the paper**

This randomized control trial utilized methods to measure spinal reflex excitability, presynaptic inhibition, and postsynaptic inhibition that were consistent with other studies. The researchers took care in ensuring that all participants received treatment from the same physical therapist and followed the same morning pre-testing protocol to limit confounding variables. Other studies have found that lumbopelvic manual therapy interventions briefly decrease spinal reflex excitability in other body regions (e.g. gastrocnemius and soleus) and increase voluntary quadriceps activation; however, this study does not support that a decrease in spinal reflex excitability is the mechanism for increased voluntary quadriceps activation. While all participants in the lumbopelvic manipulation positioning group (no thrust), patellar mobilization (Grade IV and Grade I), and control groups received the same treatment, it was curious that participants in the lumbopelvic joint manipulation group received varying numbers of manipulations (between one to four manipulations with a maximum of two per side starting with the ipsilateral side of knee pain) depending on whether or not a cavitation was heard or felt by the physical therapist or participant. In the results section, the authors acknowledged literature that supported a cavitation may not be necessary for clinically relevant outcomes; therefore, it seems that the variability in the number of lumbopelvic joint manipulations received and lack of tracking/reporting of this variability is inconsistent with the literature and a limitation of this study. Additionally, while this study did not find any differences between manipulation, mobilization, and control groups on a mechanistic level (spinal reflex excitability), it did not report on other biopsychosocial factors (e.g. pain, patient-reported function) that may be affected by manual therapy treatment.

**Please provide your clinical interpretation of this paper. Include how this study may impact clinical practice and how the results can be implemented.**

The results of this study do not immediately impact clinical practice. As other research supports that manual therapy provided in addition to exercise and best care leads to the greatest improvements, physical therapists will continue to provide lumbopelvic joint manipulation and patellar mobilizations to treat knee pain. However, the physical therapist providing these treatments will not be able to defend a decrease in spinal reflex excitability as the mechanism for a decrease in pain, improvement in function, or improvement in voluntary quadriceps activation based on the results of this paper. The results of this paper may inspire this team of researchers or others to pursue future randomized control trials to better understand the mechanism of manual therapy treatments, as well as further explore the effects of manual therapy on patient-reported pain and function in individuals with knee pain.