**Article Full Title**

The immediate effect of lumbopelvic manipulation on EMG of vasti and gluteus medius in athletes with patellofemoral pain syndrome: A randomized controlled trial

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**Paper Abstract**

The purpose of this study was to evaluate the immediate effect of lumbopelvic manipulation on EMG activity of vastus medialis, vastus lateralis and gluteus Medius as well as pain and functional performance of athletes with patellofemoral pain syndrome. Twenty-eight athletes with patellofemoral pain syndrome were randomly assigned to two groups. One group received a lumbopelvic manipulation at the side of the involved knee while the other group received a sham manipulation. EMG activity of the vasti and gluteus Medius were recorded before and after manipulation while performing a rocking on heel task. The functional abilities were evaluated using two tests: step-down and single-leg hop. Additionally, the pain intensity during the functional tests was assessed using a visual analog scale. The onset and amplitude of EMG activity from vastus medialis and gluteus medius were, respectively, earlier and higher in the manipulation group compared to the sham group. There were no significant differences, however, between two groups in EMG onset of vastus lateralis. While the scores of one-leg hop test were similar for both groups, significant improvement was observed in step-down test and pain intensity in the manipulation group compared to the sham group. Lumbopelvic manipulation might improve patellofemoral pain and functional level in athletes with patellofemoral pain syndrome. These effects could be due to the changes observed in EMG activity of gluteus medius and vasti muscles. Therefore, the lumbopelvic manipulation might be considered in the rehabilitation protocol of the athletes with patellofemoral pain syndrome.

**NIH Risk of Bias Tool**

Quality Assessment of Controlled Intervention Studies

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

Yes

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

Yes

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

Yes

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

Yes

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

Cannot Determine, Not Reported, or Not Applicable

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

Yes

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

Yes

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

Yes

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

Yes

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

Yes

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

Yes

**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

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

Yes

**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**

The lumbopelvic manipulation increased the EMG amplitude of the gluteus Medius muscle which was significantly different from the sham group.

**Key Finding #2**

In the manipulation group, the mean change in pain score was about 2 points which was significantly different from the sham group.

**Key Finding #3**

Results of functional performance test revealed significant improvement after manipulation in the scores of both one-leg hop and step-down tests in the intervention group.

**Key Finding #4**

The manipulation of the lumbopelvic region might be considered in the rehabilitation protocol of the athletes with PFPS.

**Please provide your summary of the paper**

This study focused on two hypotheses regarding the effects of lumbopelvic manipulation on EMG activity of the quadricep muscles, lower limb function, and pain intensity in athletes with PFPS. The first being that a lumbopelvic manipulation could improve the EMG parameters of GM and vasti muscles. It was found that within the intervention group, there was significant improvement in the EMG onset of VMO and GM, as well as an increase in the EMG amplitudes of VMO, VL, and GM in the intervention group. The combination of increased EMG onset and amplitude of the quadriceps muscles, might have decreased the amount of femoral adduction and internal rotation, restoring normal tracking of the patella leading to less pain and better performance in functional tasks. This leads to the second hypothesis being that an immediate improvement would be observed in the clinical outcomes following the lumbopelvic manipulation. The study found that the knee pain immediately decreased after the lumbopelvic manipulation, while no significant change was seen in the sham group. The results of the functional performance tests, one-leg hop, and step-down tests revealed significant improvement after manipulation, however only the score of the one-leg hop test was significantly different between the two groups. Although there was evidence of immediate effects due to a lumbopelvic manipulation on athletes with PFPS, further research should be conducted to evaluate the long-term effects to assess whether it should be implemented as part of a treatment protocol for patients.

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

The effects PFPS can have on a patient’s physical impairment, varies due to several factors. These factors are unique to each patient including their physical activity levels, human anatomy (alignment of femur), and pain tolerance. This study helped highlight that a lumbopelvic manipulation can have positive effects on pain and functional performance tests, however it is always important to individualize each session based on the patient that is presented in front of you as this technique may not work for everyone.