**Article Full Title**

THE EFFECTS OF POSTERIOR TIBIAL MOBILIZATION ON MENISCAL MOVEMENT: AN IN-SITU INVESTIGATION.

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**Paper Abstract**

Background: Anterior knee pain during knee extension may be related to a meniscal movement restriction and increased meniscal load during function. One method of treatment involves the use of manual posterior mobilization of the tibia to specifically target the meniscotibial interface of the knee joint. Purpose: The purpose of this study was to measure motion at a cadaveric medial meniscus anterior horn during a posterior tibial mobilization. Study Design: Prospective, multifactorial, repeated–measures laboratory study. Methods: Eight unembalmed cadaveric knee specimens were mounted in a custom apparatus and markers were placed in the medial meniscus, tibia and femur. The tibia was posteriorly mobilized in two randomized knee positions (0 degrees and 25 degrees) using three randomly assigned loads (44.48N, 88.96N, and 177.93N). Markers were photographed and digitally measured and analyzed. Results: All load x position conditions produced anterior displacement of the meniscus on the tibia, where the displacement was significant [t (7) = -3.299; p = 0.013] at 0 degrees loaded with 177.93N (mean 0.41±0.35 mm). The results of 2(position) x 3(load) repeated measures ANOVA for meniscotibial displacement produced no significant main effects for load [F (2,14) = 2.542; p = 0.114) or position [F (1,7) = 0.324, p= 0.587]. All load x position conditions produced significant posterior tibial and meniscal displacement on the femur. The 2(position) x 3(load) repeated measures ANOVA revealed a significant main effect for load for both femoral marker displacement relative to the tibial axis [F (2,14) = 77.994; p &lt; 0.001] and meniscal marker displacement relative to the femoral marker [F (2,14) = 83.620; p &lt; 0.001]. Conclusion: Use of a mobilization technique to target the meniscotibial interface appears to move the meniscus anteriorly on the tibia. It appears that this technique may be most effective at the end range position. Level of Evidence: 2 (laboratory study) Keywords: Anterior knee pain, Knee, Meniscus

**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**

No

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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?**

Cannot Determine, Not Reported, or Not Applicable

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

Cannot Determine, Not Reported, or Not Applicable

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?**

Cannot Determine, Not Reported, or Not Applicable

**Key Finding #1**

The greatest anterior displacement of the medial meniscus occurred during condition three (0deg 0N-0deg 177.93N).

**Key Finding #2**

Femur displacement, relative to tibial axis, was present during all conditions, and significantly effected by load (not significant for position x load or position alone).

**Key Finding #3**

Load produced a significant effect on meniscal femoral displacement, whereas position x load and position alone did not have such effect.

**Key Finding #4**

Tibial angle moved into more knee extension more with greater load intensity, regardless of position. In addition, with the higher loads (all but 44.48N), more movement into extension occurred at 25 degrees than 0 degrees

**Please provide your summary of the paper**

This study presents details of how the inert tissues (tibia, femur, and medial meniscus) of the knee joint move in reponse to a posterior tibial mobilization with various joint angle and force combinations performed on 8 cadavers. The study is limited by the scale and transferability to live subjects. Authors of the study suggest, based on the findings, that the most effective position for moving the meniscus with a posterior mobilization would be 0 degrees and using force less that 177.93N.

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

While this study is limited as a laboratory study on cadavers, it can be helpful in directing further studies on effectiveness of manual techniques by directing which conditions would be most likely to achieve meniscal movement. Noting that force was the greatest indicator of displacement across findings, it seems logical that in human trials, force will be a key to improving clinical indicators of a successful intervention and would be likely that even greater forces may be required when considering non-cadaver subjects.