

**A critical appraisal of “Effects of Experimental Anterior Knee Pain  
on Muscle Activation During Landing and Jumping Performed at  
Various Intensities”**

**By**

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## **Abstract**

The outcome of anterior knee pain on neural activation of the lower extremity is largely unknown, specifically in jumping and landing activities. The effect of such pain on specific muscle groups is not clearly understood. The study to be appraised focuses on specific lower extremity muscles using surface EMG to detect muscle activation during jumping and landing activities at high and low intensity when exposed to experimental anterior knee pain. This article was strengthened by clearly stated purposes and hypothesis. The authors then time to speculate on the reasoning for contrary findings and stated that more research would need to be done for verification. This article may have been weakened by its lack of conformity to accepted parameters of Randomized Clinical Control Trials (RCT). There was no stated randomization or blinding and subjects were recruited to participate. Overall the strengths of this study outweigh the weaknesses and provide better insight into muscle activation in the presence of anterior knee pain.

## **Key words**

Knee, Experimental Pain, Anterior, Jumping, Landing

## **Introduction**

There is progress to be made in the area of muscle activation as a result of knee pain. This study is aimed at determining if knee pain independently affects lower-extremity muscle activation during landing and jumping performed at different intensities. These researchers hypothesized that experimental knee pain would independently alter lower-extremity activation. I have decided to appraise this study to assess the strength of the research, results and methods to give an honest interpretation of the findings. My question of interest was: Does knee joint pain

effect muscle activation/strength during jumping activities? Changes in muscle activation are a common accompaniment of injury, surgery and the extent thereof is not specifically known.

## **Methods**

During my search for literature I used EBSCO/Medline and Pub Med Central databases as they have a wide reach. I limited results to “full free text”, to simplify the acquisition process, “humans”, for direct implementation, and “years”, for recent research. I excluded “foreign language” to eliminated translation. I included “gender” to see results in application to men and women. I included “experimental”, this would eliminate surveys, self-reporting, or studies that do not test a hypothesis. I knew generic searches would yield many hits, with keyword “knee pain” I was expecting around 10,000 and ended up being 25,000+. Using specific words, I could yield around 50 hits. When I used specific journals, it was significantly less, 5-7 hits.

This article was published by the Journal of Sport Rehabilitation in 2017, and was written by J. Park, W. M. Denning, J.D. Pitt, D. Francom, J. T. Hopkins, and M. K. Seely. Collaborating authors were associated with; Kyung Hee University, Yonin, Republic of Korea, Weber State University, Brigham Young University, University of California Santa Cruz. Direct location of trial was not openly stated in the research article. It is not conventional in many ways due to the nature of the trial. There were contraindications and limitations that were openly addressed by the researchers. I was interested in what they would conclude even with these issues. The study had groups of similar sociodemographic, clinical and prognostic characteristics. Specific inclusion and exclusion criteria were set to make sure the individuals were similar. The groups/trials were managed in the same way except, for the experimental intervention. No subject attrition occurred during the study due to the 48hr window. This made all data available for study.

## **Results**

### Summary of the study

The purpose of the study was to determine whether knee pain independently affects lower extremity muscle activation during 2 different land and jump tasks performed at low and high intensity in forward and lateral directions. 13 subjects participated. Everyone underwent 2 data collection sessions 48 hours apart. 2 double-leg forward jump (high/low intensity), and 2 single-leg lateral jump (high/low intensities). Double-leg activity required subjects to jump forward over an obstacle and land upon force plates, then as quickly as possible jump forward again from the force plates over a second obstacle that was equal to the first and land at a second location. Subjects performed this as a control trial and then subjects received a 1-mL injection of hypertonic saline into the right infrapatellar fat pad. Pain was determined every 2 minutes using a visual analog scale. EMG was attached to right leg gastrocnemius, vastus medialis, medial hamstring, gluteus medius and maximus. Overall, there were patterns seen of decreased EMG amplitude, due to the experimental knee pain, during landing (eccentric) and increased EMG amplitude due to experimental knee pain during jumping (concentric) was observed for gastrocnemius, medial hamstrings, and gluteus medius muscles. There was contraindication for muscle groups and it was speculated that this was due to compensation methods. Shifting forces due to inhibition of specific muscle groups. In the end, the results showed that knee pain, alters activation of before mentioned muscles during landing and jumping at different intensities.

### Appraisal of the study introduction

The introduction is strong, comprehensive and provided detailed background information. It included a stated purpose, hypothesis, background, applications and general facts.

“Purpose of this study was to determine whether knee pain independently affects lower extremity muscle activation during 2 different land and jump tasks (forward and lateral) performed at a low and high intensity”. It also provided research references to all claims. The author used around 30 sources to provide rationale for this study. They did well showing the need for this particular research. All sources by my definition are from credible journals. All are well used in PT and Athletic training. The oldest study used was from 1960, however most of the research cited was from the last 20 years.

The lone weakness I observed was in the references used in the introduction. The author J. Ty Hopkins name comes up often in the reference section. He is an author of this research. This could be problematic as there could be bias in trying to link his research together, a “conflict of interest” so to speak. This study could be a continuation of previous findings, it is unknown. References 25,29,35 all have his name in them. 25 is used in the introduction for supporting evidence. There are no specific problems or weaknesses other than this in the introduction.

#### Appraisal of the study methods

The intervention is clearly described. This can be repeated, in fact, this study uses the same methods as similar studies. Referenced studies that used same methods were used and changes made to fit the research question. 13 volunteers participated in the study. There was no subject attrition over the study. The study is within-subjects design, each subject completed a control trial as well as trials with the application of the independent variable. The participants were of similar status, they were around 22 years old, similar in height, weight, free from neurological disorders, lower extremity injury within 6 months, lower extremity or spine surgery within their lifetime, and free of pain. All were right leg dominant. All groups were managed in the same way for the experimental interventions.

There might be trouble replicating the study due to the small sample size specifically, the lack of diversity given about the subjects. The findings may only apply to a certain group. This study has aspects of quasi-experimental and has aspects of a RCT. In the text they state, “We used a laboratory-based, pretest, posttest, repeated-measures design, where all subjects completed 2 data collection sessions.” It may be classified as quasi-experimental due to lack of randomization and lack of blinding. This study can be considered a short longitudinal however, the subjects were never followed therefore it can be called cross-sectional. Due to the information given it is difficult to say if there was some sort of bias which would make the findings inapplicable to the general population.

#### Appraisal of the study results

The results section is well organized and broken down by specific muscle to show the effects of each treatment including the control. They also identified negative support to their hypothesis. Results match the research question. They address the research question throughout the text. Regarding their purpose and hypothesis, the paper shows that they held to their design questions. The figures and tables gathered are well described and clearly labeled.

There was nothing given regarding MCID or NNT. This could have helped the reader be more informed as to the significance of the findings. Other than this, weaknesses were lacking.

#### Appraisal of the study discussion

The discussion flowed well and was very informative as to what should be done with the findings. They considered all findings and tried to justify, speculate and explain the reasoning using previous research. Authors used unexpected findings as a strength. Questionable results were used as a possible topic of future research. The authors points were well established and were supported by

reputable references. The discussion was clear, refocusing on the purpose of the study. Statements reiterated the application of these findings.

Even though the discussion was well written it may be too verbose, overwhelming the causal reader. They take much of the discussion to talk about findings that did not benefit their hypothesis. In the end they state clearly the question, “Why is there inhibition of certain muscles and stimulation of others?”.

## **Discussion**

Knee pain will alter neuromuscular activation. This opens the door for further study of specifically inhibition and amplification. PTs’ can use this information in assessing injury for the subject. It allows the PT to understand the danger of knee pain and understand compensation which could lead to further injury. This study directly answers the clinical question I formed and then sought out through research. This study gives a clear answer that altered muscle activation exists with experimental knee pain and further study is needed to see the reason why.

There is statistically significant evidence supporting their findings. Clinicians and coaches can implement these findings with few risk factors. These findings can be used to advise caution and to address or potentially resolve knee pain before/while abnormal mechanics are addressed. This could give concrete support to the common practice of delaying high-intensity rehabilitative exercise, specifically involving landing and jumping until knee pain is resolved. A clinician would be at low risk implementing these findings in a rehabilitation plans. The potential benefits outweigh the non-existent risks in this case without argument. If this article had cited specific research indicating that altered muscle activation puts individuals at risk for injury the choice to implement would be even more clear.

As an aspiring Physical Therapist, implementation of these findings would not be difficult. This can be implemented in rehabilitation plans, given to patients as prognosis for the future, or in education for those that work with athletes. I would be comfortable implementing the findings due to the cautious nature of the protocol. It could give the understanding and reason to protect an individual that has knee pain. If I was to enter the workforce today as a therapist, I would anticipate that I would use this knowledge to protect and rehabilitate those with knee pain. Conservative treatment of knee pain and reduced high-intensity training is already used in practice. It is cautious and focused on the root of the issue instead of treating the signs of the consequence of pain.

Overall, this article was organized well, provided ample referenced claims, and took the time to apply findings for implementation as well as set up future research questions. The research design was organized but not in conventional terms, and this may be the lone argument against this study. Need of a follow up study is evident and should be expected based on the tone of this research.