A critical appraisal of "The efficacy of continuous passive motion in the rehabilitation of anterior cruciate ligament reconstructions."

By

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In partial fulfillment of the

requirements for the course:

PT 7240 Evidence-Based Practice in Physical Therapy

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October 2020

Abstract:

This paper delves deeply into the comparison of two different rehabilitation methods following ACL reconstructive surgery. In pursuit of more information in this field, a literature search was performed, and one journal article was selected for appraisal. This journal article, *The efficacy of continuous passive motion in the rehabilitation of anterior cruciate ligament reconstructions*, compares the efficacy of continuous passive motion (CPM) to the efficacy of early active motion training. The authors do this by taking patients directly after surgery and placing them into three different treatment groups: one practicing only CPM training, one practicing only early active motion training and one practicing both treatments. The researchers measured the subject's knee range of motion and anterior laxity and then compared the three groups at certain intervals of time up to 6 months post-surgery. After the 6 months had passed, the researchers found that both rehabilitation methods achieved the same range of motion and stability levels and that there were no significant differences in the results between the three groups. These results were clinically significant because they proved that both methods are equally efficient and safe. This conclusion benefits the field because it allows patients and healthcare providers to have more viable options for ACL rehabilitation without sacrificing stability or range of motion.

Key words: ACL, reconstruction, continuous passive motion machine, early active motion training, review

Introduction:

When going through ACL rehabilitation, early movement after surgery is completely essential. There are usually two main options that patients can choose from for rehabilitation, continuous passive motion training or early active motion training. Choosing the correct rehabilitation strategy is very important in regaining full function and stability when it comes to ACL reconstruction recovery. But how are patients supposed to choose between these two options? In order to answer this question, a literature search was conducted while using the following clinical question: In patients with ACL tears, what is the effect of a CPM (continuous passive motion) machine on mobility after surgery compared to not using a machine? While pursuing an answer to this question, one article stuck out among the available literature and is being further explored in this critical appraisal.

Methods:

I started my search for literature in this field by using the PubMed database. I used PubMed because I found it to be more inclusive and reliable compared to the other options. I also used the Cochran Library for one specific search in order to narrow my search to include only allied health articles. I used multiple search terms when looking for information in this field. Some of these terms included: “ACL”, “reconstruction”, “continuous passive motion”, “passive motion” and “active motion”. While searching for articles, I placed specific limits on the language and the type of article shown in the results. I filtered out everything except for full text articles in order to save time during my search. In another effort to narrow my results, I also filtered the results to only include clinical trials and randomized controlled trials rather than including reviews/systemic reviews or meta-analysis. Once I had all of my hits, I filtered through the

available article's populations and interventions. In terms of population, I tried to exclude any knee procedures that used the CPM machines other than ACL reconstructions. In terms of intervention, I included all ACL reconstruction interventions that included a continuous passive motion machine. I anticipated having around 50-100 articles to look through. However, once I applied my exclusions and filtered the population and intervention, there was a much smaller amount of papers to look through.

This article was published in *The American Journal of Sports Medicine*, Volume 20, Number 2 in 1992. The study was done from the Southern California Center for Sports Medicine in Long Beach California by Mark A. Rosen, MD, Douglas W. Jackson, MD and E. Allan Atwell, MD. This study focused on the efficacy of a CPM machine compared to the efficacy of early active motion training after an ACL reconstruction surgery. I chose this study because it seems like it was performed very thoroughly. The researchers ensured that all of the groups in the study were treated the same way except for the application of the different interventions. The researchers took extra care to ensure that each surgery was performed by the same surgeon and used the same type of graft before they started the study. All of the patients also wore the same brace after surgery and were seen by the doctor at all the same intervals. Because they all had the same characteristics as subjects, they were able to be assigned to the three different groups completely randomly, which reduces bias between the different study groups. Finally, the investigators collected data at discharge all the way until 6 months after surgery. In ACL rehabilitation, 6 months after surgery was long enough to observe the outcomes of interest in all of the subjects.

Results:

Summary of the study

This article examines the differences between early active motion and continuous passive motion in the overall rehabilitation of arthroscopic ACL reconstruction surgery. Many different variables were accounted for in regard to the surgeries, they included: drain output, medication use, tourniquet time, leg involved, length of hospital stay, KT-1000 testing and knee range of motion. Other measures, such as radiographs and the International Knee Evaluation Form, were used to appraise the specific data collected from the study. This data was collected from 75 patients who had an arthroscopic ACL repair surgery without any other connective tissue repairs (meniscus or other ligaments). These 75 patients were separated into 3 groups of 25 participants. These group assignments decided how patients would approach early range of motion training. Group A only participated in early active motion training. Group C participated in only continuous passive motion training using a machine. Finally, group B participated in a mixture of both passive and continuous motion training. After the study was finished, researchers found that at discharge, the one week mark, and at each monthly interval that there were not significant differences between early active motion, continuous passive motion, and a mixture of both. This was proof that the use of CPM machines would not have advantageous or disadvantageous effects on an individual who was recovering from an arthroscopic ACL reconstruction surgery when compared to early active motion training.

Appraisal of the study introduction

The authors used the literature review to present sound reasoning for conducting the study. By only involving animal/cadaver research for continuous passive motion in the literature review, they show that there is a need for this research on live human subjects. The references used in the literature review

mostly seem credible. Many of these references are from the same journals such as: *The Journal of Bone and Joint Surgery, The American Journal of Sports Medicine, The International Journal of Sports Medicine,* and *Clinical Orthopedics.*

While the introduction was precise and presented the information well, the researchers could have included more background on the subject matter without it being tied into a previous article during the literature review. Because this article was published in 1992, it is already slightly dated. Because of this, most of the references used are from the 1970s and the 1980s. There are two articles from the 1950s and one from the 1960s so these could definitely be classified as weaker sources since they are so much older than the other references and the research article itself. There is one source that is from an instructional course lecture in 1979, so there may be some personal bias that could affect the validity of this reference. The researchers also did not clearly notate where the abstract ends and the introduction begins, there is just a paragraph break between the sections which could be confusing to the reader. The introduction also fails to mention that the study would be comparing the results of the CPM machine rehabilitation to the effects of early active motion training rehabilitation. Despite these weaknesses, the introduction was still very well written and presented the reasoning for the study in a clear and concise way.

<u>Appraisal of the study methods</u>

The study design was an experimental study, specifically a randomized control trial design. The study was also a prospective and longitudinal study. There were 75 total participants in the study and none of them withdrew/were excluded from the study. There were three groups of 25 subjects, and it was a between-subjects design because each group only performed their specific condition rather than performing all of the experimental conditions. The group assignments were randomly assigned through a lottery system but after the groups were assigned, the researchers knew which group each participant

was in. There is not a lot of specific information presented about the knowledge of the subjects, but they obviously knew whether or not they were using a CPM machine or not after surgery. This study design was strong because it made sure that the participants could be treated the exact same way other than the intervention and that the subjects could be followed long enough for the results to be clinically significant. The outcome measurements would also be easy to replicate if the appropriate equipment was available (the KT-1000) and because manual ROM testing with a goniometer and the heel height test are easy to replicate in the clinic. Overall, all of these outcome measurements were reliable and user-friendly.

Some of the subjects required extra surgeries such as early manipulation under anesthesia due to lack of ROM or the repair of a cyclops lesion. These subjects could have had an impact on the results of the study due to delayed healing times and that they were not treated the exact same way as the other participants. This study was very specific on the type of surgery, surgeon, and graft used in surgery and was even more specific when it comes to the therapy used after surgery. It was also a study that went for 6 months post operation with very specific parameters on rehabilitation, so it would take a decent amount of time and effort to replicate this exact study even though the outcome measures are easy to replicate.

Appraisal of the study results

The results section was written in a manner that was clear and easy to understand with multiple headings to separate the information. In the objective data section, the authors outline the results of the study and present tables for the ROM and KT-1000 data. Information on patient compliance, associated knee injuries, use of analgesics, radiographic assessment, complications and cost differences were also presented in this section. There are three different figures that the authors used in order to present the

results. All of these figures are well made and clear to the reader with captions that further help the reader understand how the data is being presented.

There were not many weaknesses when it comes to the results section. All of the results were presented very clearly and concisely. The only apparent weakness was that there was not a specific explanation of how the results in table 2 and table 3 were compared and how it was decided that there were not significant differences between the groups. If they had been more specific about this, it would minimize any confusion about the results.

Appraisal of the study discussion

The discussion section definitely delved deeper into the findings and explained their meanings more clearly than the results section. In this section, the authors connected the findings from the study to the findings in the literature that they introduced earlier in the paper. The authors did a great job of referring back to the studies that they were trying to critique in the literature review and connecting the past results to the results from the current study. This helped the reader to see that the current study was able to show that the CPM machine did not affect the integrity of the ACL graft and that it was just as effective as the early active motion training.

The first weakness in the study discussion was that the limitations of the study were not listed in the discussion section and were instead placed in the results section of the paper. The second weakness was that the authors did not suggest any kind of future study to expand on their findings in different scenarios or in a larger sample.

Discussion:

This study was important for the field because it proves some of the other studies about CPM machines to be wrong. In a previous study, the CPM machine was said to cause disruption on the

fixation sites of cadaver ACL reconstructions. In another study, the CPM machine was found to be less effective than early active motion training. This study proves that both of the current rehabilitation options are safe for patients to use and, if used correctly, have almost equal amounts of efficiency in regard to recovery of function. I found this article to be very important because it came to a neutral conclusion, which means that both of these methods can be used on patients. This is important because it gives more options to the healthcare team in case one of the methods is not appropriate for a patient. Overall, these results help to give patients more options and more of a choice when it comes to their rehabilitation. The study in general was well written and very concise with only a few weaknesses reported.