The Effects of Opioid Analgesics on Physical Therapy Effectiveness

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Received 9 May, 2020; accepted 15 May, 2020

Abstract

Within the last decade, the Center for Disease Control (CDC) have recorded epidemic levels of prescription opioid use. The increased consumption of these analgesics is leading to several related health issues that have a negative impact on the patient’s overall health. In many cases, physical therapy and opioid pain management are used in conjunction with one another to relieve pain. The premise of this study is to shed light on whether opioid use affects physical therapy effectiveness. There are different aspects to physical therapy efficacy, and these could be differentially influenced by opioid use. Opioid-induced hyperalgesia could enhance perception of pain and interfere with pain alleviation during course of treatment. Whereas other, non-nociception-related standards of effectiveness may not be different between the two groups as physical therapy is primarily targeting the musculoskeletal system. The two sample groups consisted of patients that were using opioid analgesics and those who were not, while being treated with physical therapy. The data was collected retrospectively from patients with lower back pain indication. Several therapy tests were analyzed to statistically verify any difference between outcomes and effectiveness between similar patients. The test results taken from patient evaluations were active range of motion (AROM), verbal pain rating, lower extremity (LE) strength, functional outcomes, and therapy goal achievement. The data resulted in significant differences in pain mitigation and achievement of therapy goals which resulted in a rejection of the null hypothesis. However, differences with non-nociceptive related aspects of physical therapy such as AROM and LE strength were not significantly different. This data suggests there are indication of nociception related issues of patients who utilize opioids during physical therapy and could pose a contraindication for opioids in some therapy patients.

Keywords: opioid, analgesic, physical therapy, opioid-induced hyperalgesia

Introduction

Opioid analgesic use to relieve chronic and acute pain is on the rise in the United States and has led to a rise in secondary conditions such as aggravation of affected areas, addiction, and other physiological/psychological abnormalities (Gladkowski et al. 2014). For some, long term opioid use can result in a condition known as opioid induced hyperalgesia (OIH), whereby the patient experiences a hypersensitivity to painful stimuli (Lee et al. 2011). Physical therapy, in many cases, is also prescribed to treat chronic and acute pain. In many instances, the two are prescribed in conjunction with one another (Thackeray et al. 2017). Which brings us to the question; do opioids interfere or benefit the patient when used in conjunction with physical therapy?

Analgesics are defined as a group or class of drugs that relieve pain by targeting the central and peripheral nervous systems. Analgesics do not completely eliminate sensations or motor control like anesthetics, rather, they dull the feeling of pain by blocking pain receptors (Grady et al 2011). Some of the most common forms of prescribed medications during therapy are opioids, steroids, muscle relaxants, and anti-inflammatory drugs. Opiate based drugs, or opioids are derived from opium poppies and are highly effective for relieving pain. The most common drug names associated with opioids are morphine, codeine, oxycodone, and hydrocodone (Grady et al 2011). These drugs influence the cerebral serotonin and norepinephrine receptors in the brain and can be highly addictive with long term use and because of this they have contributed to a medical epidemic in the United States (Grady et al 2011). Every year millions of Americans use opioids to manage chronic pain but may not be fixing the root problems leading to chronic use and addiction. There were 214 million prescriptions for opioids in 2016 and more than 11 million people abusing opioids (Scholl et al 2018).

Physical therapy is an alternative treatment method to analgesic pain management. Physical therapy treatments involve biomechanics, kinesiology, manual therapy, exercise therapy, and a variety or modalities (Crossley et al 2002). These strategies help to remediate impairments and promote mobility and function (Hoving et al 2002). The process for a patient

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to receive physical therapy starts with their primary care or orthopedic care physician who will prescribe physical therapy to a patient that is experiencing a loss in mobility or is experiencing musculoskeletal pain (Thackeray et al. 2017). The physical therapist diagnoses the patient’s condition and develops a plan to reduce pain and increase mobility of the affected areas which usually involves therapeutic exercise and manual mobilization (Hoving et al 2002). This treatment cycle would continue for 2 to 3 times a week for however many weeks the therapists prescribes. Their progress is measured and compared to their initial results by using standardized questionnaires and measuring techniques for the specific area affected. In this study we will examine the active range of motion (AROM), verbal pain rating, functional outcomes, lower extremity strength (LE strength), and therapy goal achievement to determine if therapy effectiveness was influenced by opioid analgesics.

For this study, lumbar pain was the indication used for the criteria of patient selection and assessment. The lumbar AROM is measured in degrees or mobility for flexion, extension, and lateral bending. Lower extremity (LE) strength was measured using a one through five-point system according to the medical research council criteria. LE strength test is pertinent to lumbar pain and is analyzed as a control for lumbar and pelvic instability (Sousa et al. 2019). Functional outcomes are assessed using the Oswerty disability index questionnaire. These scores are reflective of the patient’s percent of disability to perform tasks for daily living. Pain is measured by a verbal pain scale ranging from 1-10 and is reflective of the patient’s current and most intense bouts of pain. Physical therapy goals are reasonable progress checkpoints that the patient and therapist agree upon during the initial evaluation. At the end evaluation, the therapist will decide whether it is appropriate to continue therapy or seek other avenues of pain mitigation and restoration of mobility per the patient’s pre-established goals.

Though opioid analgesics and physical therapy are used separately and in conjunction with one another, the problem lies with the fact that opioids have the ability to influence the quality of treatment, healing progression, and pain management that is inherent with physical therapy treatments (Gladkowski et al. 2014). Opioids can distort the sensation of pain through OIH and the pain tolerance of the patient can be skewed during evaluations for physical therapy treatment (Lanier et al 2009). There is also speculation that the opioid analogesics could give false mobility and range of motion measurements due to the skewed pain tolerance as well (Lee et al. 2011). After collecting data that quantitatively measures the progression of patients on opioids and those without, we can compare the results to conclude if there is a difference in physical therapy outcomes.

**Methods**

Prior approval of this study was needed to access and collect patient medical records. The CSU Stanislaus Institutional Research Board approved the execution of this study per the given testing parameters and HIPAA compliance procedures (approval# 1920-071). This experiment was carried out on Microsoft Excel. Excel was used to chart data, and an authorized computer was used to collect patient information on a medical record keeping program called ‘Clinicient’ from the Central Valley Physical Therapy (Stockton CA) medical records database. No patient contact was necessary for this experiment. All data collection was retrospective from dates ranging from 2014 to 2019. After data collection was complete, statistical analyses was used to compare and derive results.

Patients will be allocated to the different conditions set forth by the variables: opioid and non-opioid user for the mitigation of lumbar pain. The data collected attempted to show a correlation between opioid use during physical therapy and their measured progress after treatment. The null-hypothesis states; there is no difference between physical therapy treatment effectiveness/progress in patients who use opioids for pain and physical therapy patients who do not.

The sample size for this experiment consisted of 40 patient records, 20 allocated to each group that fit the following criteria: All patients must have a lumbar pain related diagnosed condition and have been prescribed a treatment plan. The control group will consist of non-opioid users and the experimental group will consist of opioid users during PT treatment. This variable is classified as a patient that is prescribed a daily regimen of at least one opioid analgesic.

Effectiveness and progress are defined as the amount of progress the patient has made regarding AROM, LE strength, functional outcomes, verbal pain scores, and PT goal achievement. The improvement of these scores from their initial baseline evaluation encompasses the meaning for “progress and effectiveness” and was evaluated in absolute units and percent difference.

**Results**

The data for this study was collected for the two groups of twenty patients and consisted of AROM, verbal pain score, LE strength, functional outcomes, and PT goal achievement. Secondary demographic data was collected for this study as well, this included sex, age, health insurance type, and opioid type. AROM results for the non-opioid group were at a 14.75% change on average versus the opioid group that had a 4.35%
positive change on average, see Figure 1. The distribution of the percent change for the control group is more typical with fewer outliers than the opioid group. AROM percent change showed no statistical difference \((p > 0.05)\). However, the percent change averages were quite different with 14.75\% for non-opioid and 4.35\% for opioid patients.

![AROM Change](image)

**Figure 1:** The figure above represents the active range of motion (AROM) percent change for the lumbar spine of both the non-opioid and opioid group \((p > 0.05)\).

The verbal pain scale absolute change values were calculated by taking the difference of the end of treatment evaluation and the initial evaluation, see Figure 2. The average initial pain score for the non-opioid group was 6.725. The opioid group had an average initial pain score of 8.663. The non-opioid group had an average change of -3.05. The opioid group showed a -1.7 average change with a change median of -0.875. The overall decrease in pain score for the non-opioid group was 95\% and 60\% for the opioid group. Initial pain was shown to be statistically significant \((p < 0.001 \ ***\)). Patients in the non-opioid group had a significantly lower initial pain than the opioid group which could be consistent with opioid induced hyperalgesia. The overall decrease in pain was statistically significant \((p < 0.01 \ **\)). However, change in pain was not statistically significant \((p > 0.05)\). This indicates that the non-opioid group had a significantly higher number of patients who experienced decreases in overall pain after treatment versus opioid patients. Ultimately, physical therapy is meant to decrease the pain in patients, and this supports the effectiveness of therapy without the use of opioids. This assumption is based on the 95\% of non-opioid patients experiencing a decrease in pain at the end of treatment versus 60\% in opioid patients \((p < 0.01 \ **\)), see Table 1.

![Pain Change](image)

**Figure 2:** The figure above represents the verbal pain scale rating absolute change from the initial and ending treatment evaluations of both opioid and non-opioid group \((p > 0.05)\).

Lower extremity strength data was collected for initial and end treatment evaluations for both groups. The scale was 1 to 5 with 5 representing normal to above normal strength. The absolute positive change average was 0.524 for non-opioid group and 0.467 for opioid group, see Figure 3. The standard error of the mean was 0.0731 for the non-opioid group and 0.105 for the opioid group. Overall, LE strength change was not statistically significant \((p > 0.05)\). This was a surprising result because it was one of the only tests that seemed to have little variation between the non-opioid and opioid group. As LE strength is a known indicator for pelvic and lumbar instability, the results show very little difference in that regard between groups.

![LE Strength](image)

**Figure 3:** The figure above represents the lower extremity strength average change in absolute units from 1-5 along with error bars representing the standard error of the mean of both opioid and non-opioid groups, respectively \((p > 0.05)\).
The functional outcome data was analyzed by taking the difference of the final and initial functional outcomes and deriving percent change, see Figure 4. The positive percent change signifies the decrease in disability. The functional outcome percent change average for the non-opioid group was 43% and 21% for the opioid group. The standard error of the mean for the opioid group was 8% and 11% for the non-opioid group. These results were not regarded as significant (p > 0.05). The overall decrease in disability percent shown in Figure 5 displays a nominal difference between the groups regarding decrease, no change, and increase in percent disability at the end of treatment.

**Figure 4:** The figure above represents the positive change in functional outcomes of percent disability. The standard error of the mean is represented by the error bars (p > 0.05).

**Figure 5:** Functional outcome represents percent of disability using the Oswery lower back pain questionnaire. This graph displays the percent of patients from each group that experienced a decrease, no change, and increase in percent disability at the end of their treatment versus their initial evaluation (p > 0.05).

The non-opioid group demonstrated a 65% goal achievement and 35% continued treatment recommendation after their prescribed therapy was concluded, see Table 1. The opioid group demonstrated only 20% goal achievement and 80% continued treatment recommendation. These results are statistically significant (p < 0.01 **). This result is an indication that the opioid group showed a higher occurrence of not meeting end treatment goals that were established at the beginning of treatment. This is due to a failure to successfully reach the benchmarks of each test in a way that renders the patient able to perform tasks of daily living with proper mobility and with the absence of pain after physical therapy treatment has concluded.

This data indicates that there is a difference between opioid and non-opioid patients in terms of initial pain, decrease in pain at end of treatment, and therapy goal achievement. Opioid patient group data for these tests are interpreted as being negative for the use of opioids during treatment but had little effect on other musculoskeletal tests.

**Discussion**

Some measurements we examined showed a statistically significant difference between the non-opioid group and the opioid group of patients. However, some objective musculoskeletal tests proved to not be significantly different. AROM percent change showed a p-value slight above significant, but the percent change averages were quite different with 14.75% for non-opioid and 4.35% for opioid patients. The p-value could be skewed by using percent change instead of absolute value due to unequal testing parameters taken at the time of patient evaluation. Some patients were missing one or more measurements, for example, some patients only had extension and flexion while others had all four. This made it difficult to compare patient data to one another in absolute terms and we had to use percent change in order to compare the results. No significant correlations were found between age versus AROM and initial pain versus AROM and there was no correlation between change in pain values and AROM.

The LE strength data was found to not have any statistically significant difference between the two groups. This could be due to LE strength not having a significant impact on lumbar pain. Perhaps the patients that were chosen all had stable conditions regarding stability of the lumbar and pelvic regions. This could also have attributed to the reason for AROM not being significantly different between the groups as well. It could be assumed that certain musculoskeletal functions such as range of motion and LE strength are not affected by opioid use to cause a significant difference in percent
A similar result was found in the function outcome test which resulted in a p-value of almost double 0.05. Percent change of disability for the non-opioid group was 43% versus 21% for the opioid group which may seem significant, but due to the broader range of the non-opioid group, it resulted in a higher standard deviation which may have affected the p-value for this test. Much like the AROM test, it was difficult to compare results of the patients due to the starting baseline values being different from one another. The percent change for some patients were artificially higher than others due their range of percent disability. Therefore, it was more appropriate to analyze the data by assigning the percent disability to syntax that denoted increase, decrease, and no change.

One of the most significant pieces of data for opioid group differences was the initial verbal pain score given at the beginning treatment evaluation. There was a statistically significant difference regarding the initial pain ratings between the groups (p < of 0.001***). Patients in the non-opioid group had a significantly lower initial pain rating than the opioid group which could be consistent with opioid induced hyperalgesia. The opioid group also did not experience as much pain mitigation at the conclusion of their therapy treatment. These results indicate the possibility for hypersensitivity for pain or could mean that opioid use is ineffective at managing their pain. Moreover, the non-opioid group data indicated a higher percent of pain mitigation at the end of treatment. Non-opioid patients also showed a higher percentage of goal achievement. Ultimately, physical therapy is meant to decrease the pain in patients and increase mobility for therapy goal achievement. This notion supports the effectiveness of therapy without the use of opioids. For many, failure to achieve physical therapy goals typically results in continued therapy or may result in continued opioid use.

Due to the results of the study the data suggests that we reject the null hypothesis. Therefore, we recognize there is a significant difference in physical therapy outcomes and effectiveness between opioid using patients and non-opioid using patients. This claim is based on the result for pain improvement and therapy goal achievement.

A possible skewing of results may be related to patient compliance of home exercise programs. This study assumes that all patients had equal participation in home exercise programs and therefore would have similar results in improvement. Another unaccounted-for variable is the dosing and duration of opioid consumption since this could skew the degree at which OIH can skew pain results. There are many variables that are involved with this type of research and not all can be controlled, these include prior conditions, variability in therapy strategy, prior physical fitness of patient, etc. In the future if this study were replicated, I would use a larger sample size and control more variables such as dosages and duration of opioid use. I would make sure all testing parameters were accounted for so that all measurements can be compared using absolute values instead of percent change.

This research will be useful to patients that are seeking a treatment plan for their condition and enlighten care providers to the effects of opioid analgesics on therapy effectiveness. Ultimately, because of the small sample size and range of participants the results will not apply to all cases. Instead, it will be used to inform those affected by pain causing conditions and create awareness. Moreover, this study will serve as a pilot study for more in-depth research due to the results of the study.

Table 1: The table below presents the statistically significant data for initial pain mean, decrease in pain, and physical therapy goal achievement. The non-opioid group displayed a positive significant difference in all categories.

<table>
<thead>
<tr>
<th></th>
<th>Non-Opioid</th>
<th>Opioid</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Pain Mean (Pain scale units)</td>
<td>6.725</td>
<td>8.663</td>
<td>(p &lt; 0.001) ***</td>
</tr>
<tr>
<td>Decrease in Pain (% of patients)</td>
<td>95</td>
<td>60</td>
<td>(p &lt; 0.01) **</td>
</tr>
<tr>
<td>PT Goal Achievement (% of patients)</td>
<td>65</td>
<td>20</td>
<td>(p &lt; 0.01) **</td>
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</table>
Acknowledgements

The author of this study would like to thank Central Valley Physical Therapy (Stockton, CA) and Movement 4 Life Clinics for making their facilities available for this study. Special thanks to Dr. Jamila Newton for being the key advisor to making this study a success.

References


