The Effects of Guided Imagery on Post-operative Pain and State Anxiety in Total Knee Arthroplasty Patients

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ABSTRACT

Background: After total knee arthroplasty, adequate management of post-operative pain and anxiety without adverse side effects is improving advanced patients’ outcomes.

Objective: This study aimed to examine the effects of guided imagery on postoperative pain and state anxiety in total knee arthroplasty patients.

Methods: The study employed a quasi-experimental research design. The sample consisted of 64 patients who underwent total knee arthroplasty divided into two groups, with 32 subjects in each group. The subjects in the control group received routine nursing care, whereas those in the experimental group received routine nursing care plus guided imagery therapy. Outcome measures were the numeric rating scale for pain score and the State Anxiety Inventory for anxiety score.

Results: The experimental group had significantly lower scores of pain and anxiety than the control group (p-value = .0035 and .012 respectively).

Conclusion: Guided imagery is an alternative treatment that can be used to supplement pharmacological treatment to effectively reduce pain and anxiety in patients undergoing total knee arthroplasty.

Keywords: Total knee arthroplasty, pain, anxiety, guided imagery

E-journal: http://www.sirirajmedj.com

The success of total knee arthroplasty is the patients’ speedy improved recovery and ability to resume activities of their daily living. Thus, after undergoing total knee arthroplasty, all patients have to receive physical rehabilitation within the first three days after the surgery. However, a major problem which barriers patients’ physical rehabilitation is their painful knee joint during enhanced range of motion of the knee joint and load weight bearing during gait training. Besides pain, another important problem after total knee arthroplasty is state anxiety which associated with pain and reduced functional improvement. The severe pains in patients undergoing total knee arthroplasty make these patients avoid rehabilitative activities; and hence reduce mobility in the knee joint. A normal response in nature to pain is to reduce activity or limit movement of the leg which can lead to decreases in the metabolism of the muscles, which can lead to muscle atrophy and stiffness of the knee joint which are crucial to recovery after orthopedic surgery. State anxiety can affect various facets of pain perception, where heightened state anxiety leads to increased self-reported pain intensity, reduced pain tolerance, and decreased pressure pain thresholds and anxiety levels have been shown to predict pain severity and pain behavior in acute and chronic pain patients.

The current standard treatment for post-operative orthopedics pain and anxiety remains the use of medications, including opiates and antioxystic drug. Pharmacological intervention would appear as an easy and handy remedy, Yet, this intervention has some limitations associated with the side effects of sedation, confusion, weakness and gait instability, fall and incontinence in all age groups, especially in the elderly. Furthermore, most patients with osteoarthritis are elderly patients who have already experienced deteriorating functioning
and physical conditions, so the risks of the side effects of medications can become even more severe.\(^\text{10}\)

Guided imagery is frequently used to provide a way of coping with pain and anxiety by using verbal suggestions to create a flow of positive thoughts and/or positive mental attitude and also it stimulates the functioning of the hypothalamus, autonomous nervous system, and pituitary gland to secrete the endorphin hormone which is a happy substance that makes individuals perceive pleasure\(^\text{1,12,13}\) and deviate from the pain and anxious situations to something more pleasant, reduce negative thinking, and increase the self-control ability, hence a feeling of satisfaction and happiness is produced.\(^\text{14}\)

**MATERIALS AND METHODS**

**Study design**

The study employed a quasi-experimental pretest-posttest control group design. Participants were selected from the schedule of patients with knee osteoarthritis who underwent elective total knee arthroplasty (TKA) in a special orthopedics ward at the Police General Hospital during August 1, 2008 to March 31, 2009. Eligibility criteria were alert, oriented, no major hearing deficit and literate in Thai. Exclusion criteria were those who suffered from post-operative shock, had severe nausea and vomiting, or had cognitive impairment. This study had been approved by Mahidol University Institutional Review Board, Certificated number MU-IRB 2008/054.2207.

After signing the consent form, study participants were randomized with equal probabilities into control or experiment groups, with 32 subjects in each group. The control group received the usual care. In addition the experimental group received a guided imagery Digital Video Disc (DVD) developed by Bumpenjit Sangchart. This 15 minute guided imagery DVD consisted of music and positive narration to facilitate relaxation and restructure thinking toward positive thoughts, and contained vivid imagery about beautiful scenes, sounds, and comfortable feelings instead of feelings of pain and anxiety. Narration started with directing the participant to relaxa and progressed downward from the head to the feet, and then to continue the section of the imagery was guided to imagine a pleasant scene, either a beach, a hillside with flowers, a wooded area, or a backyard. The narration led the participant to use their vision, hearing, touch, and smell to imagine very specific aspects of the scene, which made participants feel satisfied, refreshed, relaxed, and happy before ending with fading soft music.

**Measurement**

Post-operative pain was measured by the use of the numeric rating scale of pain (NRS) report on a scale from 0 to 10, with 0 representing no pain and 10 representing the worst possible pain. State anxiety was measured by the State Anxiety Inventory which was developed by Spielberger, which consists of a set of 20 statements in which the respondent shows how anxious he/she feels on a four-point scale with total scores ranging from 20 to 80 with high scores indicating a higher anxiety, with Cronbach’s alpha coefficient of 0.84.

**Data Collection**

**One day before the surgery**

The experimental subjects were instructed to use of the guided imagery DVD and were asked them to listen to the guided imagery DVD at least twice a day.

The control subjects received routine nursing care.

**24 to 48 hours after the surgery (when the patients attempted first walking practice)**

The experimental subjects received the treatment as follows: First, the researcher assessed their pain and state anxiety. Second, the researcher introduced and demonstrated walking with a walker aid to them. Third, the researcher assessed their pain at the 0 minute of walking. Then, the researcher let the subjects rest on the bed in a comfortable position and listened to the guided imagery DVD. Finally, the research assistant assessed the subjects pain at 15, 30, and 60 minutes after walking and their state anxiety at 60 minutes after walking. The control subjects received the treatment exactly the same as the experimental subjects without listening to the guided imagery DVD.

Data regarding demographic characteristics of the subjects were analyzed in terms of frequency distribution, percentage, mean, and standard deviation, and the independent sample t-test which was used to determine the differences in mean scores of pain and the differences in mean scores of anxiety between the experimental subjects and the control subjects.

**RESULTS**

1. **Demographic characteristics of the subjects**

The findings revealed that patients with osteoarthritis who underwent total knee arthroplasty were mostly female (90.6%), and about three-fourths of them (75%) were married. Close to two-thirds, or 62.5% in the control group and 62.6% in the experimental group, completed elementary education, and 68.8% were unemployed. In terms of age, most of the subjects in both groups ranged in age from 60 to 80 years old (84.4% and 85.8% in the control and experimental groups, respectively). In addition, the mean body mass index of the control subjects was 27.14 kilograms per meter\(^2\), while that of the experimental subjects was 26.166 kilograms per meter\(^2\).

2. **Results of hypothesis testing**

**Research hypothesis 1:** The patients with total knee arthroplasty who received guided imagery therapy had a lower level of pain than that of the patients who received only routine nursing care.

The research findings showed that when calculating the difference in mean scores of pain between the subjects in the experimental group and the control group using the independent t-test, the findings were as follows (Table 1).

At 15 minutes after walking, the pain level of patients with osteoarthritis who underwent total knee arthroplasty in the experimental group was lower than that of the patients in the control group with statistical significance at the 0.05 level (\(p\)-value = .0015), the mean score of pain of the experimental subjects was equal to 2.44 points, with the standard deviation of .801, while that of the control subjects was 3.06 points, with the standard deviation of 0.801. Furthermore, at 60 minutes after walking, the pain level of patients with osteoarthritis who underwent total knee arthroplasty in
the experimental group was lower than that of the patients in the control group with statistical significance at the 0.05 level (p-value = 0.0035), the mean score of pain of the experimental subjects was equal to 1.66 points, with the standard deviation of .545, while that of the control subjects was 2.03 points, with the standard deviation of 0.538 respectively. As a result, research hypothesis 1 was supported.

Research hypothesis 2: The patients with total knee arthroplasty who received guided imagery therapy had a lower level of anxiety than that of the patients who received only routine nursing care.

The research findings showed that when calculating the difference in mean scores of anxiety between the subjects in the experimental group and the control group using the independent t-test, the findings were as follows (Table 2).

The study findings showed that after undergoing total knee arthroplasty, the level of anxiety of the experimental subjects was lower than that of the control subjects with statistical significance at the 0.05 level (p-value = .012). The mean score of anxiety of the experimental subjects was equal to 32.06, with the standard deviation of 4.885, whereas that of the control subjects was equal to 35.91, with the standard deviation of 7.997. As a result, research hypothesis 2 was supported.

**DISCUSSION**

1. Demographic characteristics of the subjects

The findings were consistent with the findings of Kim et al. who studied the incidence of total knee arthroplasty in South Korea and reported that more than 80% of patients undergoing total knee arthroplasty were female, the mean body mass index of patients undergoing total knee arthroplasty was 26.2 ± 2.7 kilograms per meter² in males and 26.8 ± 3.3 kilograms per meter² in females. A major factor that causes osteoarthritis in the female population is heredity. It has been found that Asian females have the W200/G324 haplotype of FRZB gene, the gene coding for Frizzled-related protein 3, which is the cause of osteoarthritis. This gene is not found in the male population. In addition, in the Asian cultures, females are more likely to sit with bended knees, which increases the pressure on the surface of the cartilage, more than males. Thus, they develop osteoarthritis sooner and more often than males.

2. Results of hypothesis testing

The findings showed that the mean scores of pain and anxiety in the experimental group were lower than the control group with statistical significance at the p-value = 0.0035 and 0.012 respectively. This could be explained by that guided imagery is an imagination or creativity of a positive image in the patients mind, which is transmitted to the limbic system in the brain, hence a positive perception which in turn stimulates the autonomous nervous system and the pituitary gland to secrete endorphin, a morphine-like substance that creates the feelings of happiness, calmness, and pleasantness. Once the attention is deviated from pain, the pain sensation can be reduced. Guided imagery also a creation of positive images or ideas in one’s mind, which can be transmitted from the sensory perception to the limbic system in the brain, hence producing a positive perception leading to satisfaction and happiness and deviation from the situation that causes anxiety. The study findings were consistent with the findings of Antall & Kresevic who examined the effects of guided imagery on post-operative pain in 13 joint replacement surgery patients, with the experimental subjects receiving guided imagery with the control subjects receiving only routine nursing care.

**TABLE 1.** To compare the means scores of pain between the control group and the experimental group by using the independent t-test.

<table>
<thead>
<tr>
<th>Pain score Group (N=32)</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before walk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>1.91</td>
<td>.641</td>
<td>.678</td>
<td>.250</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.03</td>
<td>.822</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 minute after walk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>3.38</td>
<td>1.040</td>
<td>-.801</td>
<td>.213</td>
</tr>
<tr>
<td>Experimental</td>
<td>3.19</td>
<td>.821</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15 minutes after walk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>3.06</td>
<td>.801</td>
<td>-3.122</td>
<td>.0015</td>
</tr>
<tr>
<td>Experimental</td>
<td>2.44</td>
<td>.801</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 minutes after walk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2.03</td>
<td>.538</td>
<td>-2.769</td>
<td>.0035</td>
</tr>
<tr>
<td>Experimental</td>
<td>1.66</td>
<td>.545</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p <.05)

**TABLE 2.** To compare the means scores of anxiety between the control group and the experimental group by using the independent t-test.

<table>
<thead>
<tr>
<th>Anxiety score Group (N=32)</th>
<th>Mean</th>
<th>SD</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before walk</td>
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<td></td>
</tr>
<tr>
<td>Control</td>
<td>38.47</td>
<td>6.839</td>
<td>.775</td>
<td>.226</td>
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<tr>
<td>Experimental</td>
<td>39.72</td>
<td>6.402</td>
<td></td>
<td></td>
</tr>
<tr>
<td>60 minutes after walk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>35.91</td>
<td>7.997</td>
<td>-2.320</td>
<td>.012</td>
</tr>
<tr>
<td>Experimental</td>
<td>32.06</td>
<td>4.885</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(p <.05)
The study findings revealed that guided imagery is an alternative treatment that can be used to supplement pharmacological treatment to effectively reduce pain and anxiety in patients undergoing total knee arthroplasty.

In addition, the findings indicated that during the first two days after undergoing total knee arthroplasty, the level of pain of patients ranged from moderate to severe, with the mean scores of pain of 4.88 and 5.00 in the control group and the experimental group, respectively. After that, the level of pain would gradually subside. Before rehabilitation of the knee joint with exercises to increase the range of motion of the joint and walking practice, the level of pain of patients was slight, with the mean score of pain of the experimental subjects equal to 2.03 and that of the control subjects equal to 1.91. However, after the patients got up and walked, the pain scores increased with statistical significance at the .05 level ($p$-value = 0.000). The mean score of pain of the experimental subjects was equal to 3.19, while that of the control subjects was equal to 3.25. One explanation is that total knee arthroplasty results in damage to tissues, muscles, bones, and periosteums. The receptors of pain signals called nociceptors transduce pain into action potential and transmit the signals to the primary afferent neurons along the A-delta and C fibers to the ascending sensory pathway to the dorsal horn of the spinal cord, which connects to the neurons. Then, the modulation of pain signals takes place, and the injury data are transmitted through the spinal tract to different parts of the brain depending on the types of injury data. This results in perception of the injury which reaches the thalamus, cortical site, and limbic system, which interprets the perception as pain. As the type of pain experienced by patients with total knee arthroplasty is acute pain, it will be reduced with time. However, the injury of the tissues stimulates the secretion of chemical aerosols in the body called endogenous chemical stimuli including Bradykinin, cytokines, potassium, prostaglandins, arachidonic acid, and substance P. These chemical substances destroy the environment of the pain receptors and lead to hyperalgesia, making pain receptors ready to be stimulated. Thus, injury signals will be continuously transmitted to the central nervous system; therefore, the pain receptors in the tissue cannot sufficiently respond to stimuli to cause the tissues’ reaction to the injury, hence allodynia. Thus, when patients exercise to increase the range of motion of the knee joint and walk, which results in stretch reflexes of the muscles, the pain receptors will be stimulated, resulting in perception of pain in nerve endings, just like when patients undergo total knee arthroplasty. As a result, the patients can also experience pain, but the level of pain is not as intense as the pain they experience during the first two days after the surgery.

REFERENCES