Preoperative education addressing postoperative pain in total joint arthroplasty: Review of content and educational delivery methods

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ABSTRACT

Objective: Evaluate content and educational delivery methods of preoperative education in total joint arthroplasties of the hip and knee (THA and TKA) addressing postoperative pain. Data sources: Systematic searches conducted on Biomed Central, BMJ.com, CINAHL, the Cochrane Library, NLM Central Gateway, OVID, ProQuest (Digital Dissertations), PsycInfo, PubMed/Medline, ScienceDirect, and Web of Science. Secondary searching (pearling) was undertaken. Data extraction: Data were extracted utilizing the participants, interventions, comparisons, and outcomes approach. Study selection: All randomized controlled trials (RCTs) evaluating the effect of preoperative education on postoperative pain in THA and TKA surgery were considered for inclusion. Limitations: Studies published in English; published within the last 20 years and patients over the age of 18. No limitations were set on specific outcome measures of pain. Data synthesis: This review included 13 RCTs involving a total of 1,017 subjects who underwent THA or TKA. Educational delivery methods comprised verbal one-on-one or group education sessions, delivered within 4 weeks of surgery lasting an average of 30 minutes, and accompanied by other written materials. The educational content centered on descriptions of preoperative preparation, hospital stay, surgical procedure, immediate/intermediate experiences, expectations following surgery, rehabilitation, encouragement/reassurance, and answering common question associated with the surgical experience. Conclusions: Preoperative education centered on a biomedical model of anatomy and pathoanatomy as well as procedural information has limited effect in reducing postoperative pain after THA and TKA surgeries. Preoperative educational sessions that aim to increase patient knowledge of pain science may be more effective in managing postoperative pain.

INTRODUCTION

Pain is a common postoperative issue that many patients are left to face (Cheung, Callaghan, and Chang, 2003; Douglas, Mann, and Hodge, 1998; Fisher et al, 2004; LaMontagne, Hepworth, Salisbury, and Cohen, 2003; Pellino et al, 1998). In 1975 and 1978, two pioneer studies by Hayward and Boore (Oshodi, 2007a, 2007b) found that structured preoperative education had an effect on postoperative pain, anxiety, and recovery. Since these early studies, numerous articles have been published on the effect of preoperative education on alleviating postoperative complications. These areas of research include cardiac surgery (Arthur et al, 2000; Deyirmenjian, Karam, and Salameh, 2006; Roth-Isigkei et al, 2002; Shelley and Pakenham, 2007; Wang, Shen, Lu, and Yang, 2008), abdominal surgery (Cheung, Callaghan, and Chang, 2003; Oshodi, 2007a; Wilhelm et al, 2009; Young, de Guzman, Matis, and McClure, 1994; Zieren, Menenakos, and Mueller, 2007), dental surgery (Mladenovski and Kieser,
an appropriate intervention to decrease postoperative pain.

The U.S. population is aging (Kent, Funk, and Crandall, 2002) and more individuals have need for total knee arthroplasty (TKA) and total hip arthroplasty (THA) surgeries (McDonald, Hetrick, and Green, 2004; Swanson, Schmalzried, and Dorey, 2009) and subsequent need for postoperative pain control. A systematic review of the literature regarding the content and delivery methods of preoperative education addressing postoperative pain is needed. The primary research question for this systematic review was to determine if any preoperative education strategies utilized in orthopedic surgery for THA and TKA could be shown to positively affect postoperative pain, and to also determine the best content and delivery methods of that preoperative education.

METHODS

The protocol for this study was reviewed and deemed excluded from Institutional Review Board review by Stellenbosch University Board of Institutional Review/Ethics.

Definitions

The following terms and definitions were applied to the review:

- **Preoperative**: Care given before surgery when physical and psychological preparations are made for the operation, according to the individual needs of the patient. The preoperative period starts from the time the patient is admitted to the hospital or surgery center to the time that the surgery begins (Webster’s, 2008).

- **Perioperative**: The period of time extending from when the patient goes into the hospital, clinic, or doctor’s office for surgery until the time the patient is discharged home (Webster’s, 2008).

- **Patient education**: Any set of planned educational activities designed to improve a patient’s health behaviors, health status, or both. Such activities are aimed at facilitating the patient’s knowledge base (Lorig, 2001; Oshodi, 2007a).

Search strategy

An electronic search was performed in February 2011, covering the last two decades (1990–2011) of the following databases: Biomed Central, BMJ.com,
TABLE 1 Inclusion criteria used in the systematic review.

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>English language</td>
<td>Major journals in this area are published in this language</td>
</tr>
<tr>
<td>1990–2011</td>
<td>Twenty years captures the most recently used treatments in clinical practice</td>
</tr>
<tr>
<td>Humans over 18 years of age</td>
<td>This increased the homogeneity of participants between studies and educational needs are different for infants, adolescents, and teenagers</td>
</tr>
<tr>
<td>RCTs</td>
<td>RCT’s provide high levels of evidence. Study designs other than RCT were not included in this review because of the low level of evidence they provide</td>
</tr>
<tr>
<td>Patient education</td>
<td>No limitations were set on the content or methods used in patient education, since it was one of the aims of this review to source the content and education delivery methods</td>
</tr>
<tr>
<td>Outcomes: postoperative pain</td>
<td>The primary outcome measure chosen for this review was postoperative pain. No limitations were set on the measurement tool used to examine the effect of preoperative education on postoperative pain</td>
</tr>
<tr>
<td>Preoperative</td>
<td>All studies that intervened with an educational strategy prior to the surgical procedure were included. No limitations were set on the timing of the education prior to surgery</td>
</tr>
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</table>

TABLE 2 Hierarchy of evidence, study design, based on the Australian NHMRC Hierarchy of Evidence.

<table>
<thead>
<tr>
<th>Level</th>
<th>Definition</th>
<th>Studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Evidence obtained from at least one properly designated RCT</td>
<td>Gammon and Mulholland (1996)</td>
</tr>
<tr>
<td>III-1</td>
<td>Evidence obtained from well-designed pseudo-RCTs (alternate allocation or some other method)</td>
<td></td>
</tr>
<tr>
<td>III-2</td>
<td>Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomized, cohort studies, case–control studies, or interrupted time series with a control group</td>
<td></td>
</tr>
<tr>
<td>III-3</td>
<td>Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Evidence obtained from case series, either post-test or pre-test/post-test</td>
<td></td>
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</tbody>
</table>

CINAHL, the Cochrane Library, NLM Central Gateway, OVID, ProQuest (Digital Dissertations), PsycInfo, PubMed/Medline, ScienceDirect, and Web of Science. Each database has its own indexing terms and functions, and therefore different search strategies were developed for each database by the authors. The main key words used for the search items were: preoperative, perioperative, pre-admission, orthopedic, surgery, arthroplasty, replacement, spine, education, instruction, advice, inform, consultation, and pain. In PubMed, medical subject headings (MeSH) terms were used where possible, with Boolean operators. The search strategies for reviewing the remaining databases included searches using synonyms of the main keyword search items. Secondary searching in the form of “pearling” was undertaken, whereby reference lists of all included articles were searched for additional relevant studies not identified in the primary search. The titles and abstracts of all the identified literature were screened by the one reviewer using the selected inclusion criteria. The full text of all potentially relevant articles were retrieved and then screened by the remaining three reviewers using the same criteria to determine the eligibility of the paper for inclusion in the review. All members of the team are engaged in research on pain science education and have successfully published in this area.
Inclusion criteria

All titles and abstracts were read to identify relevant papers. Papers were included in this systematic review if they met the inclusion criteria listed in Table 1. When there was uncertainty regarding the eligibility of the paper from the abstract, the full text version of the paper was retrieved and evaluated against the inclusion criteria. The full text version of all papers that met the inclusion criteria were retrieved for data extraction.

Quality assessment

Critical appraisal of each included study was conducted by determining the level of evidence on the Australian National Health and Medical Research Council (NHMRC) Hierarchy of Evidence (Table 2). This provides a broad indication of bias based on study design. Studies higher on the hierarchy contain less potential bias than those that are lower on the hierarchy.

Data extraction

Data were extracted by the authors using the participants, interventions, comparisons, and outcomes approach (Stone, 2002).

- Participants: type of surgical intervention, age, and gender;
- Interventions: type, intensity, duration, educational tools/props, and in combination or stand-alone education;
Comparison: to another treatment, no treatment, or “usual” treatment;  
Outcomes: domains and tools used to measure the effects of the intervention. The outcome chosen for this review was postoperative pain.

RESULTS
Search strategy yield
Initially, 1,901 hits were gained from databases and secondary searches. After review of the titles and abstracts, those articles that did not meet the inclusion criteria were removed (Figure 1). The reviewers found 265 potentially eligible abstracts. Review of these abstracts suggested 51 full text articles to further review. These full text articles were then analyzed for duplications and non-applicability, leaving only 13 published studies fully meeting the criteria for inclusion in this systematic review. This systematic review is based on these 13 published studies (Table 3).

Critical appraisal

Hierarchy of evidence


Patient characteristics

The reviewed articles included a sample of 1,021 patients receiving preoperative education: 712 patients...
TABLE 4 Participants, interventions, controls, and outcomes for the studies included in this systematic review.

<table>
<thead>
<tr>
<th>Author</th>
<th>n</th>
<th>Sample</th>
<th>Diagnosis</th>
<th>Intervention</th>
<th>Control</th>
<th>Instruments</th>
<th>Follow-up</th>
<th>Main results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Louw et al</td>
<td>6</td>
<td>Preoperatively; 3, 6, and 12 months</td>
<td>No difference in strength</td>
<td>Continue with their regular activities during the last 6 weeks prior to TKA</td>
<td></td>
<td></td>
<td></td>
<td>Westerm Ontario McMasco Outcomes (WOMAC) still, Pain, Function, ROM (goniometer)</td>
</tr>
<tr>
<td>Beaupre, Lier, Davies, and Johnston (2004)</td>
<td>131</td>
<td>Experimental group: Physiotherapist</td>
<td>TKA</td>
<td>Six weeks prior to surgery = exercise/education program</td>
<td>Educator: Physiotherapist; Instruction on crash walking, stairs, bed mobility and transfer, and postoperative ROM outcome; Exercises: Stretches and strengthening with warm-up and cooldown periods; Program applied 3 x/week for 4 weeks for 12 visits</td>
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<td></td>
<td></td>
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<tr>
<td>Clode-Baker et al (1997)</td>
<td>78</td>
<td>EG (n = 41)</td>
<td>THA</td>
<td>One month prior to surgery, video, booklet and set of plastic models, mailed to patients with letter encouraging them to use the information. (92% reported that they reviewed the information prior to surgery)</td>
<td>Educator: None; No booklet, video, or joint models; Booklet: Arthritis, THA, Hospital stay, Postoperative exercise, Advice from previous THA patients; Plastic models (life-size) of the hip: Normal hip joint, Osteoarthritis, THA joint; Separate THA goodness; Photographs of the models included in the booklets; Demonstrations using the models used in the video</td>
<td></td>
<td></td>
<td>Hip function evaluation, Nottingham Health Profile, Hospital Anxiety and Depression Scale (HADS), Stress Arousal Checklist (HADS), Postoperative pain (descriptive ordinal scale), Sleep disturbance, Satisfaction questionnaire, LOH</td>
</tr>
<tr>
<td>Daltry et al (1998)</td>
<td>522</td>
<td>Total sample: 226</td>
<td>THA and TKA</td>
<td>Education Research Assistant; Program designed by multidisciplinary team; Program: 12-minute multimedia slide program; Research assistant 1-day prior to surgery at bedside; Program designed my multidisciplinary team; Orientation to hospital; Orientation to staff and their roles; Event of surgery and rehabilitation; Link in the hospital; Pictores from the patient’s viewpoints; Total of various emotional aspects of hospitalization, including pain, immobility, work involved in rehabilitation, lights and noises, altered sleep schedules and diet, and emotional reactions</td>
<td>Information only; Information used in addition to usual preoperative information, i.e., coughing, Booklet left with patient describing milestones; Relaxation only; Oral and written instructions</td>
<td></td>
<td></td>
<td>LOH - time of discharge or more</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No indication which numbers in EG or CG</td>
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For personal use only.
### Instructed in the relaxation the day prior to surgery and encouraged to practice

- **Information plus relaxation:** Combination of the above
- **Relaxation taught after informational session**

### Five consecutive days starting on the preoperative day

- EG showed less anxiety the morning of the surgery and first 2 days after surgery compared to CG
- EG had decreased blood pressure compared to CG
- No difference in pain ratings
- EG used less pain medication compared to CG
- EG had less second cortisol compared to CG
- No change in catecholamines

### Usual preoperative care with no video presentation

- **Anxiety (STAI)**
- **Pain (VAS)**
- **Intraoperative heart rate**
- **Intraoperative blood pressure**
- **Postoperative use of pain medication**
- **Urinary levels of cortisol, epinephrine, and norepinephrine**

### THA Educator: Psychologist or physician

### THA Educator: Physiotherapist

### THA Educator: Nurse

### Educational program:

- **Day before surgery:** Patient teaching and preparatory information, Two parts:
  - Prophylactic information – early attention
  - Prophylactic information – 4–6 hours later
- Educational program:
  - Procedural information
  - Sensory information
  - Coping information
- Checklist to ensure all information was covered
- Booklet reinforcing information provided
- Postoperatively: patients visited twice weekly to reinforce the message and address problems prior to discharge, patients received second educational session regarding issues at home. Information reinforced with a booklet
- **Education coming:**
  - Prophylactic information:
    - Hospital, surgical, and anesthesia procedural information
    - Sensory information including feelings expected
    - Coping information including relaxation and distraction
  - Postoperative information:
    - Prophylactic procedural information
    - Postoperative sensory information
    - Coping information postsurgery

### No exercise or advice prior to surgery

### Barthel Index:

- One month prior to surgery
- CG: 71% (n = 29)
- EG: 82% (n = 41)

### SF-36:

- One month prior to surgery
- CG: 86/100 (n = 29)
- EG: 96/100 (n = 41)

### WOMAC:

- One month prior to surgery
- CG: 63.82 ± 9.01
- EG: 63.22 ± 9.01

### Hip Harris Score:

- One month prior to surgery
- CG: 11; 7 females; age range 44–82 years
- EG: 12; female 71% (n = 29)

### Physical Indicators of COPING Questionnaire:

- Day of discharge

### No difference in oral analgesia to manage pain

### EG used less intramuscular analgesia compared to the CG

### EG were able to mobilise sooner than the CG

### EG performed breathing and leg exercises more frequently than the CG

### EG had less second cortisol compared to CG

Continued
<table>
<thead>
<tr>
<th>Author</th>
<th>Participants</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Giraudet-Le Quintrec et al (2003) | 100 EG (n = 48); mean age 62.7 ± 8.8; female 90% (n = 44); CG (n = 52); mean age 64.3 ± 9.5; female 38% (n = 20) | THA Educator: Multidisciplinary team—rheumatologist, orthopedic surgeon, anesthetist, physiotherapist, psychiatrist
Usual verbal information and informational leaflet
Multidisciplinary information session 2–6 weeks before surgery
Invited to bring a spouse, relative, or significant other
Three to six patients per session
Session lasted half a day
Overhead transparencies
Multidisciplinary team varied on different days, but consisted of:
Surgeon
Anesthetist
Physiotherapist
Patients’ questions
Rehabilitation—physiotherapist’s part (half an hour): rehabilitation procedure (bed rest, setting up, exercises, beginning to walk, walking dangerous movements, stair climbing), rehabilitation period (going home or to a specific center: necessity, duration, physiotherapy), the role of social workers, bathing, driving, sports participation, sexual activities, patient’s questions
Psychiatrist’s and rheumatologist’s part: discussion with the patients: personal patient wait, physical, and emotional preparation, benefits of THA, personal or collective problems, and long-term precautions | Usual verbal information from the surgeon and anesthetist and the standard leaflet
State Anxiety Inventory
Pain: use of pain medication
Rehabilitation
LOH
Prior to education; just before surgery; 1 and 7 days after surgery |
At discharge; No difference

- Harris Hip Score (HHS)
- Visual Analog Scale (VAS)
- Days till:
  - Walking
  - Climbing stairs
  - Transfers

- Cortisol: day before surgery, day of surgery; first and third postoperative day
- Anxiety: HADS: day before surgery and day of surgery
- Pain (VAS): first 3 postoperative days
- McGill Pain Questionnaire Short Form (MPQ-SF) Night of the surgery, postoperative days 1 and 2

EG reported less pain at all intervals compared to the CG
TABLE 4

<table>
<thead>
<tr>
<th>Author</th>
<th>n</th>
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<th>Diagnosis</th>
<th>Intervention</th>
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<th>Main results</th>
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<tbody>
<tr>
<td>Louw et al</td>
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<tr>
<td>EG (n = 15); mean age 70.8 ± 9.3</td>
<td>25 females (71%)</td>
<td>THA</td>
<td>Not stated</td>
<td>Rehabilitation program and booklet</td>
<td>Standard pathway of care – including description of surgery, risks, estimated LOH</td>
<td>3 months postoperatively</td>
<td></td>
<td></td>
</tr>
<tr>
<td>McGregor et al</td>
<td>n</td>
<td>70.8 ± 9.3</td>
<td>Mcgregor et al (2001)</td>
<td>EG (n = 35; females 72.8 ± 10.1)</td>
<td>THA (THA Educator at discharge and 3 months post-surgery; including description of surgery; Ward Educator); under the care of THA Physiatrist (education) and physiotherapist (exercise)</td>
<td>Admission, before discharge, and 3 months postoperatively</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asplund (2003)</td>
<td>60%</td>
<td>TKA</td>
<td>Education Nurse</td>
<td>One to four days prior to surgery; Positive way; Education lasted 20–40 minutes; routine preoperative information written and verbally; information were mainly procedural; patients were more realistic compared to CG</td>
<td>No difference between EG and CG in anxiety</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Krstic (2008)</td>
<td>45 EG (n = 23): 60.05 ± 11.01 years of age; 14 females</td>
<td>THA</td>
<td>Ask questions about pain management in hospital stay</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Vukomanovic, Popovic, Djurovic, and Katic (2008)</td>
<td>45 EG (n = 23): 60.05 ± 11.01 years of age</td>
<td>THA</td>
<td>Physiotherapist (education) and physiotherapy (exercise)</td>
<td></td>
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</tbody>
</table>

Notes: STAI: State-Trait Anxiety Inventory; PCA: Patient Controlled Analgesia.
(69.7%) undergoing THA, 309 (30.3%) undergoing TKA, and no other orthopedic surgeries. Of the patients, 591 (58%) were female. The average age of patients ranged from 55.5 ± 14.4 years (Gocen et al, 2004) to 74.6 years (McDonald, Freeland, Thomas, and Moore, 2001) and the mean age (calculated as the mean of the mean reported ages) of those reviewed patients in years was 63.7 years of age.

Content of educational sessions

Details of the specific content of the educational sessions used in the studies are found in Table 4. In summary, the contents of the preoperative education sessions in orthopedics addressing pain included discussion of: mobility (i.e., crutches, bed mobility, and transfers) (Beaupre Lier, Davies, and Johnston, 2004; Doering et al, 2000; Ferrara et al, 2008; Gammon and Mulholland, 1996; Giraudet-Le Quintrec et al, 2003; Gocen et al, 2004; Lilja, Ryden, and Fridlund, 1998; McGregor et al, 2004; Vukomanovic, Popovic, Durovic, and Krstic, 2008), range of motion (ROM) (Beaupre, Lier, Davies, and Johnston, 2004; Doering et al, 2000; Giraudet-Le Quintrec et al, 2003; Gocen et al, 2004), preadmission procedures (hospital/administrative) (Clode-Baker et al, 1997; Daltroy et al, 1998; Doering et al, 2000; Gammon and Mulholland, 1996; Giraudet-Le Quintrec et al, 2003; Lilja, Ryden, and Fridlund, 1998; McGregor et al, 2004; Vukomanovic, Popovic, Durovic, and Krstic, 2008), pain overview, pain management – pharmacological and non-pharmacological, and pain communication) (Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; Gocen et al, 2004; Vukomanovic, Popovic, Durovic, and Krstic, 2008), discussion of stressful scenarios associated with surgery (i.e., pain, immobility, and noises) (Daltroy et al, 1998; Doering et al, 2000; Gammon and Mulholland, 1996; Lilja, Ryden, and Fridlund, 1998), complications (i.e., blood clots, bleeding, and death) (Giraudet-Le Quintrec et al, 2003), anesthesia and medication (Giraudet-Le Quintrec et al, 2003; Lilja, Ryden, and Fridlund, 1998; McDonald, Freeland, Thomas, and Moore, 2001), reassurance (Daltroy et al, 1998; Doering et al, 2000; Gammon and Mulholland, 1996; Lilja, Ryden, and Fridlund, 1998; Sjoling, Nordahl, Olofsson, and Asplund, 2003), milestones (Daltroy et al, 1998), movements to avoid (Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; Gocen et al, 2004; Vukomanovic, Popovic, Durovic, and Krstic, 2008), posture (Ferrara et al, 2008; Gocen et al, 2004), activities of daily living (ADL) (Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; Gocen et al, 2004), and pain education (i.e., pain overview, pain management – pharmacological and non-pharmacological, and pain communication) (McDonald, Freeland, Thomas, and Moore, 2001; Sjoling, Nordahl, Olofsson, and Asplund, 2003).

Educational delivery methods

Professionals performing preoperative education in orthopedics

Preoperative education in these cases was mostly performed by physiotherapists and nurses though other health-care practitioners were also involved (Table 4). The complete list (in order of most utilized to least) includes

1 Physiotherapist (Beaupre, Lier, Davies, and Johnston, 2004; Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; Gocen et al, 2004; Vukomanovic, Popovic, Durovic, and Krstic, 2008)
2 Nurse (Gammon and Mulholland, 1996; Lilja, Ryden, and Fridlund, 1998; McDonald, Freeland, Thomas, and Moore, 2001; Sjoling, Nordahl, Olofsson, and Asplund, 2003)
3 Psychologist/psychiatrist (Doering et al, 2000; Giraudet-Le Quintrec et al, 2003; Vukomanovic, Popovic, Durovic, and Krstic, 2008)
4 Physician (Doering et al, 2000; Giraudet-Le Quintrec et al, 2003)

Physiotherapy Theory and Practice
TABLE 5 Outcomes measures used to assess preoperative education in orthopedics for postoperative outcomes.

<table>
<thead>
<tr>
<th>Function</th>
<th>Western Ontario McMaster Osteoarthritis Index (WOMAC) – pain, stiffness, and function&lt;sup&gt;a–c&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hip function evaluation&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Hip Harris Score&lt;sup&gt;b,c,d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Barthel ADL Index&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Days till walking, climbing stairs, and transfers&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Hip Score of the Japanese Orthopedic Association&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Oxford Hip Score&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Barthel Index&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pain</td>
<td>Postoperative pain (descriptive ordinal scale)&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Pain medication use&lt;sup&gt;e–j&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>VAS&lt;sup&gt;b,c,k,l,f&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>MPQ-SF&lt;sup&gt;m&lt;/sup&gt;</td>
</tr>
<tr>
<td>ROM</td>
<td>ROM – goniometer&lt;sup&gt;a–d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>• BMRC measures of ROM&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>• Movement&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Strength</td>
<td>Quadriceps and hamstring strength – handheld dynamometer&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>BMRC measures of strength&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Psychological</td>
<td>HADS&lt;sup&gt;d,k&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Stress Arousal Checklist&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>State Anxiety&lt;sup&gt;e,h&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Mental State (Mini Mental State Exam)&lt;sup&gt;g&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Urinary levels of cortisol, epinephrine, and nor epinephrine&lt;sup&gt;k&lt;/sup&gt;</td>
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<td>Physical Indicators of Coping Questionnaire&lt;sup&gt;g&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Linear Analog Coping Scale&lt;sup&gt;e&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Positive and negative affect scale&lt;sup&gt;c&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Helplessness short subscale of the Rheumatology Attitudes Index&lt;sup&gt;e&lt;/sup&gt;</td>
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<td>Cantril Life Satisfaction Ladder&lt;sup&gt;e&lt;/sup&gt;</td>
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<tr>
<td>General health</td>
<td>Medical Outcome Study Short Form (SF-36)&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Nottingham Health Profile&lt;sup&gt;d&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Sleep disturbance&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Intraoperative heart rate&lt;sup&gt;h&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Intraoperative blood pressure&lt;sup&gt;h&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>VAS for fatigue&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Health-care utilization</td>
<td>Health-care utilization – LOH&lt;sup&gt;a,d,g,i&lt;/sup&gt;</td>
</tr>
<tr>
<td>Compliance</td>
<td>Frequency of use of interventional tools&lt;sup&gt;g&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Rehabilitation&lt;sup&gt;e&lt;/sup&gt;</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>Satisfaction with pain management&lt;sup&gt;l&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Satisfaction with nursing care&lt;sup&gt;e&lt;/sup&gt;</td>
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</tbody>
</table>

<sup>a</sup>Beaupre, Lier, Davies, Johnston (2004).
<sup>b</sup>Ferrara et al (2008).
<sup>e</sup>Gocen et al (2004).
<sup>f</sup>Vukomanovic, Popovic, Durovic, and Krstic (2008).
<sup>g</sup>Daltroy et al (1998).
<sup>h</sup>Doering et al (2000).
<sup>i</sup>Gammon and Mulholland (1996).
<sup>k</sup>Liija, Ryden, and Fridlund (1998).
<sup<l>Sjoling, Nordahl, Olofsson, and Asplund (2003).
<sup>m</sup>McDonald, Freeland, Thomas, and Moore (2001).

5 None – no health-care provider involved; only packet containing video, booklet, and plastic joint models (Clode-Baker et al, 1997)
6 Research assistant (Daltroy et al, 1998)
7 Multidisciplinary team (Giraudet-Le Quintrec et al, 2003)
8 Rheumatologist (Giraudet-Le Quintrec et al, 2003)
The timing and duration of the preoperative educational sessions provided in the reviewed studies varied considerably. Timing of provision of preoperative education was as soon as 6 weeks prior to surgery in one study (Beaupre, Lier, Davies, and Johnston, 2004), and as late as the day before scheduled surgery in four studies (Daltroy et al, 1998; Gammon and Mulholland, 1996; Lilja, Ryden, and Fridlund, 1998; Sjoling, Nordahl, Olofsson, and Asplund, 2003). Timing for the remaining studies varied from 2 and 4 weeks before scheduled surgery (Clode-Baker et al, 1997; Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; McGregor et al, 2004). Duration of the educational sessions also varied considerably (Table 4), with some sessions (video) as short as 12 minutes (Doering et al, 2000), and others as long as half a day (4 hours) (Giraudet-Le Quintrec et al, 2003). Only six of the studies reported an exact duration of the educational session and the median reported time spent on education (in the studies that reported it) was 30 minutes. The duration of the educational sessions are listed below in ascending order:

- Half day (Giraudet-Le Quintrec et al, 2003)
- 20–40 minutes (Sjoling, Nordahl, Olofsson, and Asplund, 2003)
- 30 minutes (Lilja, Ryden, and Fridlund, 1998; McDonald, Freeland, Thomas, and Moore, 2001)
- Video session lasted 20 minutes (Clode-Baker et al, 1997)
- Video lasted 12 minutes (Doering et al, 2000)

Educational format and tools

The format in which the preoperative education was delivered was primarily by means of either one-on-one verbal communication (Beaupre, Lier, Davies, and Johnston, 2004; Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; Sjoling, Nordahl, Olofsson, and Asplund, 2003; Vukomanovic, Popovic, Durovic, and Krstic, 2008) or group sessions with...
several patients (Ferrara et al, 2008; Giraudet-Le Quintrec et al, 2003; McDonald, Freeland, Thomas, and Moore, 2001; McGregor et al, 2004). One published paper delivered the preoperative education via video and a booklet only with no personal communication (Clode-Baker et al, 1997). Details of the specific educational sessions can be found in Table 4.

### Adjunct treatment to the preoperative education for THA and TKA surgery addressing pain

Several different research designs are represented in this review. In some studies, patients received various forms of other therapeutic interventions along with the preoperative education addressing postoperative pain. The therapeutic activities that accompanied preoperative education included either exercise (Beaupre, Lier, Davies, and Johnston, 2004; Ferrara et al, 2008; Gocen et al, 2004; McGregor et al, 2004) or relaxation (Daltroy et al, 1998). Only one study (Daltroy et al, 1998) examined the independent effect of an adjunct treatment (relaxation) compared to educational strategies and found no positive effect for this adjunct program. Conversely, several studies utilized education-only sessions preoperatively (Clode-Baker et al, 1997; Daltroy et al, 1998; Doering et al, 2000; Lilja, Ryden, and Fridlund, 1998) resulting in various positive outcomes (Table 4), these authors suggest that the educational sessions may be more important than the adjunct treatments in providing superior postoperative outcomes.

### Control groups

In the majority of the studies, the researchers compared the experimental protocol (preoperative education) to “usual preoperative care”, which was defined as “advice and support that would routinely be given to patients by medical and nursing staff” (Doering et al, 2000; Gammon and Mulholland, 1996; Giraudet-Le Quintrec et al, 2003; Lilja, Ryden, and Fridlund, 1998; McGregor et al, 2004; Sjoling, Nordahl, Olofsson, and Asplund, 2003). Several studies also compared preoperative education to no education and intervention (Beaupre, Lier, 

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**TABLE 6 Main findings related to pain.**

<table>
<thead>
<tr>
<th>Study</th>
<th>Positive effect</th>
<th>Neutral effect</th>
<th>Negative effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Beaupre, Lier, Davies, and Johnston (2004)</td>
<td>No difference in pain ratings</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>2. Clode-Baker et al (1997)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>3. Daltroy et al (1998)</td>
<td>Experimental group used less intramuscular analgesia compared to the control group</td>
<td>No difference in oral analgesia</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>4. Doering et al (2000)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>5. Ferrara et al (2008)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>6. Gammon and Mulholland (1996)</td>
<td>Experimental group reported less pain in all intervals postoperatively compared to the control group</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>7. Giraudet-Le Quintrec et al (2003)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>8. Gocen et al (2004)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>9. Lilja, Ryden, and Fridlund (1998)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>10. McDonald, Freeland, Thomas, and Moore (2001)</td>
<td>No difference in oral analgesia</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>11. McGregor et al (2004)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>12. Sjoling, Nordahl, Olofsson, and Asplund (2003)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
<tr>
<td>13. Vukomanovic, Popovic, Durovic, and Krstic (2008)</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
<td>No difference in postoperative pain</td>
</tr>
</tbody>
</table>

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Outcome measures

The studies in this review utilized a wide variety of outcomes measures (Table 4). The outcome of greatest interest to this review was pain. However, other measures included: function, ROM, strength, psychological issues, general health, health-care utilization, compliance, and satisfaction (Table 5).

Outcome intervals

The effect of preoperative education for these patients undergoing THA and TKA surgery was examined at various time intervals. These compared preoperative measurements to immediate postoperative, short-, intermediate-, and long-term results (Figure 2 and Table 4).

Outcomes related to pain

The primary aim of this review was to critically analyze the content and educational delivery methods associated with preoperative education for THA and TKA surgery and the effect on postoperative pain. Table 6 provides a summary of the outcomes related to pain from the studies in this review and it is evident that only one study (McDonald, Freeland, Thomas, and Moore, 2001) had a positive effect on postoperative pain as rated by patients. None of the other 12 studies produced any significant change in postoperative pain.

DISCUSSION

Efficacy of preoperative education in THA and TKA surgery

In the orthopedic domain, most studies on preoperative education have been conducted on patients undergoing: hip replacement (Butler et al, 1996; Daltroy et al, 1998; Johansson et al, 2005; McDonald, Hetrick, and Green, 2004). In 2004 and 2005, two systematic reviews evaluated the efficacy of preoperative education for TKA and THA (Johansson et al, 2005; McDonald, Hetrick, and Green, 2004). The review by Johansson et al (2005) reported on 11 RCTs involving 1,044 hip and knee arthroplasty patients. This review provided a detailed description of the educational interventions, which varied widely, and showed that preoperative education has a positive effect on preoperative anxiety levels and patient knowledge, but no changes in postoperative outcomes including pain, ROM, function, or length of hospitalization. The second review (Cochrane) conducted by McDonald, Hetrick, and Green (2004) consisted of nine studies involving 782 patients with knee or hip arthroplasty. The results from the review concurred with Johansson et al (2005) showing a wide variety of content and educational tools and the authors concluded that there is little evidence that preoperative education provides superior results in regards to pain, functioning, and length of hospitalization when compared to “usual care” in total hip and knee replacement patients. The Cochrane review by McDonald, Hetrick, and Green (2004) did however show that preoperative education has a modest effect in decreasing anxiety prior to surgery, which concurs with the Johansson et al (2005) review. Since these two reviews, several RCTs have been published evaluating the effect of preoperative education in orthopedic surgery, including TKA (Beaupre, Lier, Davies, and Johnston, 2004; Thomas and Sethares, 2008; Yoon et al, 2009) and THA (Chen and Yeh, 2005; Ferrara et al, 2008; Gocen et al, 2004; Johansson, Salantera, and Katajisto, 2007; Lubbeke, Suva, Perneger, and Hoffmeyer, 2009; McGregor et al, 2004; Thomas and Sethares, 2008; Vukomanovic, Popovic, Durovic, and Krstic, 2008; Yeh, Chen, and Liu, 2005; Yoon et al, 2009). Although our review set out primarily to determine the content and educational delivery methods utilized prior to THA and TKA surgeries to address postoperative pain, the results concur with previous systematic reviews showing that preoperative education classes do not help alleviate postoperative pain following these orthopedic surgeries.

Education delivery methods

A summary of the educational delivery methods indicates that preoperative education for THA and TKA surgery are mainly performed by nurses or physical therapists; usually occur within 4 weeks prior to surgery; and the educational sessions have a mean duration of 30 minutes. The educational material is
presented in either a one-on-one verbal format or small group sessions and is accompanied by a booklet as an adjunct to the verbal presentation. The education delivery methods used in THA and TKA surgery concur with other non-orthopedic surgery studies (Oshodi, 2007a, 2007b). Considering that this review showed a limited effect for preoperative education changing postoperative pain in THA and TKA surgery, and that the education delivery methods were similar to other types of surgery, it could be argued that the limited efficacy might be attributable to the content of the education. This argument is supported by the fact that the only study that demonstrated a benefit to decreasing postoperative pain used a similar education delivery method, but had a unique pain science education component, when compared to all to other papers reviewed (McDonald, Freeland, Thomas, and Moore, 2001).

Content of preoperative education in THA and TKA surgery addressing pain

The content covered in preoperative education in THA and TKA surgery was vast. However, of all topics covered by the various studies, only two topics covered were unique to a single study, indicating that more than 90% of the topics listed were covered by more than one study. This finding may indicate a potential agreement among the various authors on the content of preoperative education for the selected orthopedic surgeries. The content of the educational sessions include a description of preoperative preparation, hospital stay, surgical procedure, immediate/intermediate experiences and expectations following surgery, rehabilitation, encouragement/reassurance, and answering common questions associated with the surgical experience (Johansson et al, 2005; McDonald, Hetrick, and Green, 2004; Oshodi, 2007a, 2007b). In order to gain a deeper insight into the possible reason for preoperative education not positively affecting postoperative pain for THA and TKA surgery patients, the content needs further exploration. The study by McDonald, Freeland, Thomas, and Moore (2001) was the only one that showed a positive effect for preoperative education on pain, even though the educational delivery methods concurred with all the other studies in this review. McDonald, Freeland, Thomas, and Moore (2001) study, however, was unique in that its content taught basic pain management information and communication skills regarding pain prior to surgery. As a result of this education, the patients had less pain on the day of surgery and days 1 and 2 postoperatively. Although the authors were unable to determine independently if the communication skills or the content was the reason for the reduced postoperative pain, the authors concluded that “...the pain difference between the groups may be a result of the pain management education alone” (McDonald, Freeland, Thomas, and Moore, 2001). Patients are interested in learning about pain (Louw, Louw, and Crous, 2009) and recent studies in non-surgical orthopedic patients with chronic low back pain (LBP) (Moseley, 2002, 2004; Moseley, Hodges, and Nicholas, 2004) and whiplash associated disorders (Van Oosterwijk et al, 2011) have shown that patients are able to understand the presumed complexities of pain science education. Furthermore, education regarding pain science is shown to be associated with decreased perception of pain, increased function, increased movement, and changes in cognitions. These studies, which taught patients more about pain science and pain processing, rather than tissue models describing anatomy and pathology, concur with the content described by McDonald, Freeland, Thomas, and Moore (2001). It is proposed that educational programs that aim to increase a patient’s understanding of pain and the biological processes behind the pain experience may be of benefit to patients undergoing orthopedic surgery to affect postoperative pain.

The study by McDonald, Freeland, Thomas, and Moore (2001) and discussion of pain science education in non-surgical orthopedic cases highlights another possibility as to why the other studies in this review failed to provide a favorable outcome in postoperative pain. Traditional educational models are based on a biomedical model discussing anatomy, biomechanics, and pathoanatomy (Henrotin et al, 2006; Houben et al, 2005; Spoto and Collins, 2008; Weiner, 2008). Not only have these models shown limited efficacy in minimizing pain and disability, they may enhance fear (Greene, Appel, Reinert, and Palumbo, 2005; Morr et al, 2010). All the other studies in this review, and several studies in the two recent systematic reviews, indicate that anatomical, pathoanatomical, and surgical “correction” of such pathoanatomy is discussed at length with patients. Such discussion may in fact increase anxiety and fear, thus negatively impacting postoperative pain.

The proposed mechanism and future interest in developing a pain science-based educational model in orthopedics may be due to such educational strategies’ ability to enhance the patient’s ability to down-regulate input from the affected surgical area (ter Riet, de Craen, de Boer, and Kessels, 1998; Villaneuva and Fields, 2004). Even though patients are anesthetized during surgery and therefore unlikely to
be aware of any sensory stimuli from the surgical site during the surgery, the central nervous system continues to receive an enormous barrage from the surgical site due to tissue trauma generated by the surgeon (Woolf, 2007; Woolf and Mannion, 1999; Woolf and Salter, 2000). The sensory inflow generated by this noxious stimulus will produce central sensitization, an enhanced state of excitability within the nervous system (Nijss, Van Houdenhove, and Oostendorp, 2010; Woolf, 2007). When the surgery is complete and the patient awakens, likely with no recollection of the surgery, the nervous system has, in a sense, a recollection or memory of the surgery in that it is hyperexcitable. The exaggerated sensitivity the patient experiences postoperatively may be a reflection of this altered state of excitability. This postoperative pain is managed primarily via administration of drugs aimed at counteracting the pain (Mahoney, Noble, Davidson, and Tullos, 1990; Warfield and Kahn, 1995). Increasing a patient’s knowledge of pain science may alter their perception of threat and they may then experience less fear and anxiety. Additionally, the increased knowledge and understanding of pain science may help modulate the pain experience. In a case study of a patient with chronic LBP, a single pain education session led to a significant reduction in cortical activation of various areas associated with processing pain in a functional magnetic resonance imaging study (Moseley, 2005). Considering that pain science education can lead to changes in pain beliefs, such as a reduction in the conviction that pain is associated with harm and tissue damage and that pain is necessarily associated with disability (Moseley, 2005; Moseley, Hodges, and Nicholas, 2004), it seems most likely that these observed changes in brain activation might reflect reduced threat.

**Limitations**

This systematic review has limitations that should be acknowledged. The review is limited by the number of studies available, likely due to the narrow setting of the inclusion and exclusion criteria. Due to the heterogeneous nature of the studies, specifically the outcome measures used by the various authors, statistical pooling of the results was not possible and the reported efficacy of preoperative education addressing postoperative pain in orthopedic surgery is based on narrative review. The review contains only patients with THA and TKA and the effect of preoperative education on other non-THA and non-TKA orthopedic surgeries cannot be determined by the results of this review. Additional limitations include English-only studies and patient populations, thus excluding potential benefits shown by studies published in the non-English language literature. This review also excluded younger patients, thus eliminating a possible positive effect of preoperative education for younger patients facing the uncertainty of various orthopedic surgeries.

**CONCLUSION**

Preoperative education has little effect on postoperative pain in patients undergoing orthopedic surgery. Even though educational delivery methods utilized in preoperative education is similar to other non-orthopedic surgeries, it is suggested that content focusing on a biomedical model of anatomy, biomechanics, and pathoanatomy is limited in affecting postoperative pain. Educational sessions which aim to enhance patient knowledge of pain science and pain processing by the nervous system may help patients experience less fear and anxiety, and ultimately help alleviate postoperative pain. It is recommended that future research be undertaken to explore a pain education module’s ability to alleviate postoperative pain in orthopedics.

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