Evidence Review

Topic: Continuous Passive Motion therapy following Knee Arthroplasty

Background.

Continuous passive motion (CPM) is routinely given to patients following primary total knee arthroplasty (TKA) as an adjunct to physiotherapy (PT). Controversy exists, however, as to whether this device confers any significant long-term benefits to patients. Several studies (e.g., Chen et al., 2000; Pope et al., 1997) have reported that patients who received CPM therapy immediately following TKA had the same clinical outcomes as TKA patients who did not receive CPM therapy. Conversely, other studies have concluded that CPM utilization following TKA results in improved short-term range of motion (ROM; McInnes et al., 1992) and reduced rates of manipulation (Lachiewicz, 2000; Ververeli et al., 1995).

CPM as an adjunct to standard PT may result in better patient outcomes and lower resource utilization. The purpose of this review is to summarize the best available evidence on outcomes following CPM therapy after primary TKA.

Review Design.

The initial approach of this review was to identify an appropriate Cochrane review on CPM therapy following knee arthroplasty, then, using that review's search strategy and inclusion/exclusion criteria, identify relevant RCT/CCT studies that were published subsequent to the Cochrane review. Selected studies must pass methodological quality control assessment (discussed below) in order to be included in this review. This topic review will summarize the findings of the Cochrane review and of the additional selected studies on this topic.

Search Strategy.

A search of the Cochrane Database of Systematic Reviews was conducted with the following search strategy:

> ("continuous passive motion" or CPM or "passive mobilization" or "passive mobilisation" or "motion therapy").mp AND (arthroplasty or "knee replacement").mp. Limited to Systematic Reviews

The following review was identified:

> Milne et al. (2003). "*Continuous passive motion following total knee arthroplasty*"

Note: The Milne et al. (2003) meta-analysis searched literature up to 2002.

Study inclusion criteria.

The selection criteria describe by the Milne et al. review is as follows: Only RCTs of CPM therapies following knee arthroplasty were eligible. Participants were 18 years of age or older, and had a pre-arthroplasty diagnosis of degenerative joint disease. *Both* experimental and control groups received PT, while only the experimental group received CPM.

Inclusion of subsequent RCT/CCT identified on this topic had to conform to these inclusion criteria prior to being included in our review.

RCTs and CCTs in MEDLINE and EMBASE were searched using the following search strategy:

> ("continuous passive motion" OR CPM OR "passive motion" OR "passive mobilization" OR "passive mobilisation" OR "motion therapy") AND (arthroplasty OR "knee replacement") AND (RCT OR randomized OR "randomized controlled trail" OR CCT OR "controlled trial" OR "controlled clinical trial") AND English[la] AND 2003:2006[pdat] NOT review[pt]

Note: the literature search was limited to studies published in 2003 or later and, therefore, not included in the Milne

et al. systematic review. Five RCTs were identified: Davies et al., 2003; Huang et al., 2003; Bennett et al., 2005; Leach et al., 2006; and Denis et al., 2006.

Studies included.

- Milne et al. (2003). Continuous passive motion following total knee arthroplasty. Cochrane database of systematic reviews.
- Davies et al. (2003). Effect of adjunctive range-of-motion therapy after primary total knee arthroplasty on the use of health services after hospital discharge. Can J. Surg. 46(1):30-6.
- Bennett et al. (2005). A comparison of 2 continuous passive motion protocols after total knee arthroplasty: a controlled and randomized study. J. Arthroplasty. 20(2):225-33.
- Denis et al. (2006). Effectiveness of continuous passive motion and conventional physical therapy after total knee arthroplasty: a randomized clinical trial. Phys. Ther. 86(2):174-85.
- Leach et al. (2006). Continuous passive motion following total knee replacement: a prospective randomized trial with follow-up to 1 year. Knee Surg Sports Traumatol Arthrosc. [Epub ahead of print].

Studies excluded.

- Huang et al. (2003). The effect of continuous passive motion after total knee arthroplasty on joint function. (Article not retrievable for review).

Quality control.

The quality of the four selected RCT studies was assessed by two independent reviewers. Study quality was measured using a validated scale (van Tulder, 2003) that considers the RCT design, randomization, blinding, data collection and statistical analysis procedures that minimize biases. All four studies were found to have good methodologic quality and, therefore, were included in this review.

Results.

This review includes the results of the Milne et al. (2003) meta-analysis (14 trials with a total of 952 patients), plus a summary of four RCT studies (with a total of 363 patients) published after the meta-analysis.

According to the Milne et al. (2003) review, CPM combined with PT significantly increased active knee flexion at 2 weeks after TKA surgery by an average of 4.3 degrees. However, pooled analysis also revealed that CPM therapy did not improve passive knee flexion, nor active or passive knee extension at 2 weeks post-surgery. It should be noted that the pooled trials were considered homogeneous for comparison.

Pooled results also indicate that length of hospital stay (LOS) is significantly reduced for CPM patients (mean -0.7 days). Furthermore, the meta-analysis presents pooled data from three trials which indicate that CPM patients have a significantly lower incidence of post TKA manipulation. Pain medication intake was also found to be significantly less (mean -4.2mg) in the CPM group. Finally, the CPM group was found to have less knee swelling, although the meta-analysis points out that homogeneous comparison on this measure was not fully achieved.

Davies et al. (2003) examined the use of health resources (LOS and readmissions) after hospital discharge in a group of 40 CPM therapy patients, who received three 2-hour sessions beginning on the second post-operative day until discharge, with 40 control patients (both groups received standard physiotherapy). This study noted that CPM usage "had lower costs and fewer visits overall…, [but] the difference was not significant." The authors conclude that CPM therapy is not appropriate when a TKA patient is following a normal postoperative course of PT.

Bennett et al. (2005) compared the outcomes of TKA patients who received CPM at flexion and progressed towards full extension. In this study, patients were assigned into three groups: The early flexion group received CPM from 90^{o} to 50^{o} and gradually progressed to full extension over a 3-day period; a standard CPM group had CPM from 0^{o} to 40^{o} and increased by 10^{o} per day; and a no CPM (control) group. Although this study found that early flexion CPM results in better ROM of active and passive flexion in the early postoperative period, no differences among the groups were observed in LOS, wound healing rates, and postoperative (3 month and 1 year) functional outcome (Knee Society Clinical Rating System) and patient perceived health status (SF-12) scores.

Denis et al. (2006) compared the effectiveness of CPM therapy (35 min daily or 2 hours daily) versus PT alone (control) on ROM, functional ability (WOMAC) and LOS in an RCT with 81 patients. Patients were tested at baseline and at discharge, and CPM therapy was initiated on the second postoperative day and continued until discharge. This study found that adding CPM therapy as an adjunct to PT does not provide further improved knee flexion, extension, functional ability, or LOS as compared to PT alone.

Lastly, Leach et al. (2006) conducted an RCT that compared knee flexion, extension and pain scores at preoperative, discharge, 6 weeks, 26 weeks and 1 year in patients that received CPM (1 hr twice daily) or PT only (control). This study found no differences in these comparisons, and concluded that short duration CPM therapy after TKA does not influence ROM of flexion or extension, or pain.

Conclusions.

The Milne et al. meta-analysis suggests that CPM therapy combined with conventional PT may result in a small short-term increase in active knee flexion range, decrease LOS, and a lower risk of manipulation following TKA. The newer RCTs suggest that CPM may have little or no effect on ROM, although they did not address postoperative manipulations. Further research is needed to determine the effects of CPM duration and intensity on outcome measures in primary TKA patients.

ABJHI Recommendations.

The findings of a high quality meta-analysis and four methodologically sound RCTs suggest that CPM may provide a limited short-term benefit to TKA patients. Until further evidence is obtained, the results to date consistently show that CPM does not improve long-term ROM, although this therapy may reduce the risk of manipulations. CPM therapy combined with PT may be given to TKA patients, provided that the benefits of this adjunct therapy are weighed against the potential inconvenience and expense of the therapy.

Conflict of interest.

Non known.

Reference List

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