**Title:** Continuous Passive Motion in the Home Setting

**Professional**
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March 8, 2010; March 7, 2012;  
September 17, 2013; September 29, 2015;  
September 16, 2016; April 12, 2017  
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**Institutional**
Original Effective Date: March 8, 2010  
Revision Date(s): September 29, 2015;  
September 16, 2016; April 12, 2017  
Current Effective Date: September 16, 2016

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<td>• With intra-articular cartilage repair of the knee</td>
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DESCRIPTION
Continuous passive motion (CPM) devices are used to keep a joint in motion without patient assistance. CPM is being evaluated for treatment and postsurgical rehabilitation of the upper- and lower-limb joints and for a variety of musculoskeletal conditions.

OBJECTIVE
The objective of this policy is to evaluate whether continuous passive motion improves health outcomes in patients undergoing postsurgical rehabilitation in the home setting.

BACKGROUND
Physical therapy (PT) of joints following surgery focuses both on passive motion to restore mobility and active exercises to restore strength. While passive motion can be administered by a therapist, CPM devices have also been used. Continuous passive motion (CPM) is thought to improve recovery by stimulating the healing of articular tissues and circulation of synovial fluid; reducing local edema; and preventing adhesions, joint stiffness or contractures, or cartilage degeneration. CPM has been most thoroughly investigated in the knee, particularly after total knee arthroplasty (TKA) or ligamentous or cartilage repair, but its acceptance in the knee joint has created interest in extrapolating this experience to other weight-bearing joints (ie, hip, ankle, metatarsals) and non-weight-bearing joints (ie, shoulder, elbow, metacarpals, interphalangeal joints). Use of CPM in stroke and burn patients is also being explored.

The device used for the knee moves the joint (eg, flexion/extension), without patient assistance, continuously for extended periods of time (ie, up to 24 h/d). An electrical power unit is used to set the variable range of motion (ROM) and speed. The initial settings for ROM are based on a patient’s level of comfort and other factors that are assessed intraoperatively. The ROM is increased by 3° to 5° per day, as tolerated. The speed and ROM can be varied, depending on joint stability. The use of the devices may be initiated in the immediate postoperative period and then continued at home for a variable period of time.

Over the past 10 to 20 years, hospital lengths of stay have progressively shortened, and in some cases, surgical repair may be done either as an outpatient or with a length of...
stay of 1 to 2 days. As a result, there has been a considerable shift in the rehabilitation regimen, moving from an intensive in-hospital program to a less intensive outpatient program. Therefore, some providers may want patients to continue CPM in the home as a means of duplicating the services offered with a longer (7-day) hospital stay.

The focus of the current review is to examine the literature regarding home use of CPM as it is currently being prescribed postoperatively. The most important comparisons will be treatment outcomes of CPM when used alone or in addition to conventional PT, compared with conventional PT alone.

**REGULATORY STATUS**
Continuous passive motion devices are considered class I devices by the U.S. Food and Drug Administration (FDA) and are exempt from 510(k) requirements. This classification does not require submission of clinical data on efficacy but only notification of FDA prior to marketing. FDA product code: BXB.
POLICY

A. Use of continuous passive motion (CPM) in the home setting may be considered medically necessary as an adjunct to physical therapy in the following situations:

1. Under conditions of low postoperative mobility or inability to comply with rehabilitation exercises following a total knee arthroplasty (TKA) or TKA revision. This may include patients with complex regional pain syndrome (reflex sympathetic dystrophy); extensive arthrofibrosis or tendon fibrosis; or physical, mental, or behavioral inability to participate in active physical therapy.

2. During the non-weight-bearing rehabilitation period following intra-articular cartilage repair procedures of the knee (eg, microfracture, osteochondral grafting, autologous chondrocyte implantation, treatment of osteochondritis dissecans, repair of tibial plateau fractures).

B. Use of CPM in the home setting for all other conditions is considered not medically necessary.

Policy Guidelines
1. If CPM is approved, allow for a rental period no longer than 21 days from date of first application.

RATIONALE

Literature review updates of the MEDLINE database, focusing on randomized trials of continuous passive motion (CPM) used in the home setting, were performed periodically through January 25, 2017. The majority of studies identified focused on the use of CPM in the knee. Therefore, the following discussion focuses on different surgical procedures for the knee, followed by a review of literature regarding CPM for other joints.

Total Knee Arthroplasty

Early Postoperative In-Hospital Setting
The original medical policy was based on a 1997 TEC Assessment that concluded that CPM met the TEC criteria as an adjunct to physical therapy in patients undergoing total knee arthroplasty (TKA). Early studies of CPM machines focused on their use in the hospital setting, in which frequently the impact on length of stay was considered a key clinical outcome, and the TEC Assessment did not specifically examine the place of service of CPM or the length of time that the CPM machines were used. For example, a critical study identified in the TEC Assessment was a randomized study by McLennan et al that examined the use of CPM initiated in the immediate postoperative period and continued throughout the 7-day hospital stay. At 6 weeks postoperatively, the most salient difference in the 2 groups was an increased incidence of arthrofibrosis requiring manipulation in the non-CPM group.

Efficacy in the early postoperative period has been cited to support the continued use of these devices in the home setting following early discharge. CPM after TKA was the subject of a 2003
Cochrane review. This review reported that CPM combined with physical therapy was found to statistically significantly increase active knee flexion and decrease length of stay. However, the analysis suggests that the benefits of CPM in a hospital setting may be small and only short term. This Cochrane review was updated in 2010 and 2014. The updated review included 24 randomized trials with 1445 participants and examined short-term (<6 weeks), medium-term (6 weeks to 6 months), and long-term (>6 months) effects of CPM. Most of the included studies examined short-term effects. CPM was applied for 1.5 to 24 hours a day, over 1 to 17 days. A summary of the review's findings are provided in Table 1).

### Table 1. 2014 Cochrane Review Findings on CPM

<table>
<thead>
<tr>
<th>Finding</th>
<th>QOE</th>
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<tr>
<td>CPM increases passive and active knee flexion range of motion (mean difference, 2°), but the effects were too small to be clinically relevant</td>
<td>Moderate</td>
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<tr>
<td>CPM does not have clinically important short-term effects on pain (-0.4 points on a 10-point scale)</td>
<td>Low</td>
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<tr>
<td>CPM does not have clinically important medium-term effects on function or quality of life</td>
<td>Moderate</td>
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<tr>
<td>CPM may reduce the need for manipulation under anesthesia (25 fewer manipulations per 1000; risk ratio, 0.3)</td>
<td>Very low</td>
</tr>
<tr>
<td>CPM reduced the risk of adverse events (13 fewer adverse events per 1000, relative risk, 0.9)</td>
<td>Low</td>
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CPM: continuous passive motion; QOE: quality of evidence.

A 2014 Cochrane review that included 11 randomized controlled trials (RCTs) found no evidence that CPM reduced venous thromboembolism after TKA.

Yashar et al reported on a trial that randomly assigned 178 patients undergoing TKA to CPM immediately in the postoperative period or to CPM 1 day after surgery. A small but statistically significant improvement in flexion was found at the time of discharge among those started on immediate CPM, but this difference did not persist at 4 weeks. MacDonald et al reported on a randomized trial focusing on immediate postoperative versus no postoperative CPM in a group of patients undergoing TKA. Patients received a maximum of 24 hours with CPM. There were no differences between the treatment groups for ROM, length of stay, or analgesic requirements. In a trial reported by Pope et al, 53 patients were randomly assigned to either 1 of 2 different schedules of CPM (both for 48 hours) or no CPM. The use of CPM was not associated with improved long-term function or ROM. Kumar et al randomly assigned 73 patients who had undergone TKA to receive either CPM in the immediate postoperative period or a protocol of early passive flexion referred to as the “drop and dangle” technique. Patients assigned to this protocol were discharged from the hospital 1 day earlier and also had a statistically better extension range of 2.8° at 6 months compared with the CPM group.

Other RCTs have found that 2 to 4 hours of daily CPM in the hospital after TKA does not improve postoperative outcomes at discharge or follow-up. For example, Bruun-Olsen et al randomly assigned 63 patients undergoing TKA to receive active PT exercises with or without CPM to assess whether there was short-term benefit on pain or function. In both groups, exercises were performed daily for 30 minutes, starting 1 day after surgery and continuing until discharge at 1 week. For the experimental group, CPM was provided for 4 hours on the day of surgery, followed by 6 hours daily in addition to therapist-guided exercises. Blinded assessment at 1 week and 3 months after surgery showed similar results for pain and function in the 2 groups; at 1 week, both groups had visual analog scale (VAS) pain ratings of 40 and flexion scores that were within 2° of each other. Functional testing at 3 months showed no benefit of adjunctive CPM. The lack of improvement with CPM noted in these studies may be due to the practice of permitting patients to mobilize or commence flexion immediately following surgery. A 2014 study of 150
patients undergoing TKA found no benefit of CPM when used over a 2-day postoperative hospital stay.\(^{15}\)

**Non-Acute Care Hospital Setting**

In a 2014 randomized trial by Herbold et al, 141 TKA patients were assigned to either 3 hours of CPM daily or to 2 hours total CPM during their inpatient rehabilitation stay.\(^{16}\) After an average length of stay of 8 days for both groups, there were no significant differences between the CPM and no CPM groups for active ROM, Timed Up and Go test, knee girth, Functional Independence Measure scores, ambulation device at discharge, or on the self-reported Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC).

Chen and colleagues randomly assigned 51 patients in an inpatient rehabilitation service who had undergone TKA to receive conventional active physical therapy or physical therapy plus CPM.\(^{17}\) Referral to the rehabilitation center was made 5–6 days after surgery, and the majority had received CPM as part of the initial hospitalization. Knee flexion was the principal outcome. No significant difference was noted in range of passive motion between the 2 groups, as measured on admission, on the third and seventh days and at the time of discharge (8 days after admission). Thus, the use of CPM in the rehabilitation hospital offered no added benefit.

In 2012, a retrospective comparative study by the same group evaluated use of CPM in 61 matched pairs of patients admitted to a rehabilitation hospital.\(^{18}\) Outcomes following use of CPM were compared with those from a cohort of 61 inpatients who also had poor initial ROM, defined as less than 75° of active knee flexion at the time of admission, and matched for postoperative day at admission, age, length of stay, and Health Insurance Prospective Payment System (HIPPS) code. Use of CPM (2 h/d) was determined primarily by the referring physician and was used in 29% of the pool of 633 patients who had poor initial ROM. The average length of stay was 7.85 days. There were no significant differences in outcomes at discharge, including knee flexion or extension, discharge to the community, need for home care services, need for an assistive device, or functional scores on the HIPPS.

**Home Setting**

A study by Worland and colleagues was the only identified controlled study that compared the use of CPM and active physical therapy in the home setting. In this study, 80 patients undergoing TKA were randomly assigned to receive, at discharge, home CPM (3 hours/day for 10 days) versus active physical therapy, as offered by professional physical therapists.\(^{19}\) The vast majority of studies have examined CPM as an adjunct to active physical therapy; therefore, this study is unique in that CPM is proposed as an alternative. At 2 weeks, knee flexion was similar in the 2 groups, but a flexion contracture was noted in 1 patient in the CPM-only group. At 6 months, no differences were found in knee scores or knee flexion.

In another study, 60 patients with limited flexion range of motion (<80 degrees) at the time of hospital discharge were assigned to standard physical therapy alone or in combination with CPM in the home (4 hours per day) until assessment on postoperative day 17.\(^{20}\) Blinded assessment showed a trend for an increase in ROM for the CPM group (eg, 89 degrees vs. 84 degrees, respectively, \(p=0.07\)), with no differences in function between the groups, as measured by the Knee Society Score (function subscore 43 vs. 40, respectively) or the Western Ontario and McMaster Universities Arthritis Index (WOMAC) difficulty score (49 vs. 45, respectively). No differences were observed between groups in ROM or function at the 6-week or 3-month
assessment. No differences were observed for the secondary outcome measures (perceived effect, medication use, satisfaction with treatment, adherence) at any of the assessment times.

*Section Summary: Total Knee Arthroplasty*
Numerous randomized controlled trials (RCTs) have been performed comparing CPM as an adjunct to physiotherapy for patients undergoing TKA. Early trials generally used CPM in the inpatient setting and are less relevant to today’s practice patterns of short hospital stays followed by outpatient rehabilitation. Some of these trials report an improvement in range of motion for patients receiving CPM, but these improvements are short term, of small magnitude, and of uncertain clinical significance. Those RCTs that specifically evaluated CPM in the home setting did not show improved outcomes with CPM. No RCTs were identified that evaluated CPM in patients with low mobility or inability to comply with PT.

*Intra-Articular Cartilage Repair of the Knee*
Although no RCTs were identified that compared health outcomes with or without the use of CPM, CPM is apparently routinely used as a part of the rehabilitation protocol for as long as 6 weeks when weight bearing is restricted following autologous chondrocyte implantation (ACI). Basic research supports the use of CPM to obtain greater healing of articular cartilage of full-thickness defects that penetrate the subchondral bone compared with either immobilization or intermittent mobilization.

In 2010, Fazalare et al published a systematic review of CPM following knee cartilage defect surgery. The review found that CPM had been used following ACI, microfracture, and osteochondral autografts in numerous studies in the previous 5 years. Four level III (cohort) studies with 262 patients were identified that specifically compared CPM with no CPM; no RCTs were identified. Procedures in these 4 studies included microfracture, periosteal transplant of the patella, and high tibial osteotomy with either diagnostic arthroscopy or abrasion arthroplasty. CPM regimens ranged from 6 days to 8 weeks. Heterogeneity in the studies and outdated surgical techniques limited conclusions from these trials. The review concluded that those studies examining clinical outcomes of CPM did not allow a definitive conclusion of efficacy. The review cites several studies in which other outcomes (e.g., histologic outcomes on follow-up biopsies) favor CPM.

Another systematic review by Howard et al evaluated CPM and other postoperative practices after knee cartilage repair. This review cites several basic science studies that appear to support CPM. The authors identified 2 clinical studies, both of which were nonrandomized comparative studies. In 1 study, there were no differences between groups in clinical or functional outcomes at an average follow-up of 4.2 years. In the other study (N=77), patients in the CPM group (N=46) had greater improvement in grading of the cartilage lesion compared to patients who did not have access to CPM (n=31).

*Other Musculoskeletal Conditions Requiring Physical Therapy*

*Intra-Articular Knee Fractures*
Hill et al (2014) randomized 40 patients with intra-articular fractures of either the proximal part of the tibia or the distal end of the femur to standardized PT with or without the use of CPM for 48 hours postoperatively. At the 48-hour assessment, the CPM group had significantly greater knee flexion (43° difference, p<0.005). However, 6 of 20 patients were unable to tolerate CPM,
and there was no benefit to adding 48 hours of CPM when assessed at any of the follow-up visits (2, 6, 12, 24 weeks).

**Anterior Cruciate Ligament Repair**

The literature search did not identify any additional RCTs of CPM in the home setting after repair of the anterior cruciate ligament (ACL). Therefore, the studies of CPM after ACL repair in the immediate postoperative period may possibly be relevant to the home setting for patients who are discharged with an abbreviated hospital stay. The 1997 TEC Assessment concluded that CPM in the immediate postoperative period as an adjunct to conventional physical therapy offered no demonstrable advantage over conventional physical therapy alone. In a 2008 systematic review of ACL reconstruction rehabilitation, Wright et al discussed 6 randomized trials on CPM that had been published prior to 1996; no randomized controlled studies published after the 1997 TEC Assessment were identified. The review found no substantial advantage for CPM use and concluded that CPM for ACL rehabilitation could not be justified. Wright and colleagues also noted that most current ACL rehabilitation protocols initiate early motion within the first postoperative week.

**Rotator Cuff**

In 2011, Du Plessis et al published a systematic review of CPM following rotator cuff repair. Three RCTs were included, though meta-analysis could not be conducted due to heterogeneity across trials. Two of the RCTs, by Lastayo et al and Raab et al are discussed below. The third trial was a German-language report that found a significant reduction of 12 days in the time to reach 90° abduction compared with the PT control group, with no significant difference in pain between the 2 groups.

The trial conducted by Lastayo et al (1998) randomized 31 patients undergoing rotator cuff repair to a 4-week home program of CPM (average, 3 h/d) or to manual passive elevation and rotation exercises. No significant difference in outcomes was observed between the 2 approaches. Previously, Raab et al (1996) had randomized 26 patients to postoperative PT alone or to PT plus CPM. Patients were evaluated with preoperative and 3-month postoperative shoulder scores that included pain, function, muscle strength, and ROM. A statistically significant improvement was found in the subscore of ROM for those receiving CPM, although there was no significant improvement in overall shoulder score between groups. Both of these RCTs were likely underpowered to show differences on important clinical outcomes.

In 2010, Garofalo et al reported on a randomized trial assessing the effects of CPM after rotator cuff repair. During weeks 1 to 4 postsurgery, all 100 patients underwent passive self-assisted ROM exercise, with half of the patients also receiving CPM for four 30-minute sessions per day. The physical therapist–supervised exercises included pendulum movements and progressive passive abduction, forward flexion, and external rotation. When patients were not exercising, the shoulder was immobilized in a sling brace. From weeks 5 to 28 postsurgery, all patients underwent the same PT protocol. ROM and VAS ratings for pain were measured at 2.5, 6, and 12 months by an independent examiner. Between groups, VAS ratings were slightly better for patients who received CPM at 2.5-month follow-up (7.5 vs 9.1), but not at the 6-month (0.5 vs 0.6) or 12-month (0.2 vs 0.2) assessments, all respectively. ROM was significantly better in the group receiving CPM versus those who did not at 2.5-month follow-up (eg, forward flexion, 133.0° vs 120.7°) and 6 months (158.1° vs 151.7°), but not at 12 months (165.2° vs 158.0°), all respectively.
**Subsection Summary: Rotator Cuff Repair**

Three RCTs of CPM following rotator cuff surgery were identified in the English-language literature. Two of these trials reported short-term improvements in ROM for patients undergoing CPM, and 1 reported a short-term reduction in pain. None reported long-term improvements or benefits in functional status. Therefore, the clinical significance of the short-term improvements reported is uncertain. In addition, there is uncertainty about the optimal PT regimen after shoulder surgery, and so the optimal comparator for CPM is not clear.

**Hip Osteoarthritis**

One pilot study examined the use of CPM in patients with hip osteoarthritis in the absence of surgical intervention. In this uncontrolled study, CPM was used for 1.2 to 7.6 hours daily during the 12-week trial. While improvements were noted in patients’ pain assessments, a controlled trial is needed to validate this treatment effect, particularly compared with a program of regular walking.

**Adhesive Capsulitis of the Shoulder**

Dundar et al (2009) compared CPM with PT in a randomized trial of 57 patients with adhesive capsulitis (frozen shoulder). CPM or PT was provided for 1 hour a day (5 d/wk) for 4 weeks. Pain and function levels were similar in the 2 groups at baseline, with VAS scores for pain ranging from 5.44 (at rest) to 6.34 (with movement). Assessments at baseline, 4, and 12 weeks showed improvements in pain and function levels for both groups. However, CPM resulted in greater pain reduction than PT (at rest, 47% vs 25%; with movement, 35% vs 21%; at night, 36% vs 19%, all respectively). There were no differences between groups in ROM or function. This study provided modest support for the inclusion of CPM in a PT regimen for this patient population.

An RCT published in 2016 compared CPM (n=20) with PT (n=21) for the treatment of adhesive capsulitis in patients with diabetes. CPM or PT was provided for 1 hour a day (5 d/wk) for 4 weeks. All patients received electrotherapy and, after the 4-week initial treatment phase, were instructed to continue with an 8-week at-home exercise program. Outcome measures were pain (at rest, in motion, at night) and ROM (active and passive). Pain decreased significantly in both treatment groups, though patients in the CPM group reported a larger improvement in pain scores than those in the PT group. ROM improved significantly in both treatment groups as well. Patients in the CPM group reported larger improvements in abduction and flexion measures than patients in the CPM group, while external and internal rotation improvements were similar across groups.

**Elbow Contracture**

Postoperative management of open elbow contracture release with CPM was assessed in a matched cohort study by Lindenhovius et al (2009). Sixteen patients who had used CPM after open contracture release and 16 patients who had not were matched by age, sex, diagnosis, ROM, and radiographic appearance. Improvements in ROM did not differ between groups at the early (range, 4-10 months) and the final (range, 11-56 months) evaluations.

**Hand Repair**

The 1997 TEC Assessment reviewed a multicenter study of CPM in patients who had undergone flexor tendon repair, and found the data inadequate to permit scientific conclusions about CPM application.
Ring et al (1998) conducted a randomized trial that examined the role of CPM in patients undergoing silicone interposition arthroplasty of the metacarpophalangeal joints secondary to rheumatoid arthritis. Patients were randomized to a 6-week protocol of CPM (10 hands [40 joints]) or to a standard dynamic splint protocol (15 hands [60 joints]). The trial did not show better outcomes in the CPM group.

A retrospective chart review (2008) compared 15 patients who had received CPM after tenolysis with 21 who did not. Patients who received CPM improved total active motion by 40° (range, 137°-177°), while patients who did not improved total active motion by 32° (range, 152°-184°); however, this difference was not statistically significant.

Foot Repair
One study (2005) has compared CPM and immobilization following surgical treatment of idiopathic club foot in 37 infants (50 feet). The infants were randomized to CPM (4 h/d) or to casting during days 10 to 42 following surgery. Blinded analysis showed improvements in the Dimeglio Clubfoot Score with CPM (from 9.7 to 3.1) that were significantly greater than those in the control group (from 10.3 to 4.2) through 12 months (97% follow-up). Between 12 and 18 months, this trend reversed and by 48 months postsurgery, there was no significant difference between groups. Another study by the same group reported low compliance with this treatment.

Back Pain
An RCT by Gavish et al (2015) evaluated a CPM device for treatment of chronic low back pain in 36 patients. Although patients treated with the device appeared to have improved outcomes on a numeric rating scale of back pain compared to waiting-list controls, the trial had significant methodologic problems. Patients who received other treatments were excluded, a large number of subjects dropped out, and control patients did not receive any conservative management.

Stroke
CPM has been studied as a means to aid recovery of motor skills following stroke. One study (2005) randomized 35 patients to daily sessions of CPM (25 minutes) or to daily group therapy sessions consisting of self-directed ROM for poststroke rehabilitation. All patients also received standard poststroke therapy for 3.5 hours a day. After 20 days of therapy, there was a trend for greater shoulder joint stability in the CPM group (n=17, p=0.06) compared with the control group (n=15). No statistically significant differences were found for measures of motor impairment. This study had a small sample size and short follow-up period.

SUMMARY OF EVIDENCE
For individuals who have total knee arthroplasty (TKA) who receive continuous passive motion (CPM) in the home, the evidence includes randomized clinical trials (RCTs), case series, and systematic reviews. Relevant outcomes are symptoms and functional outcomes. Early trials generally used CPM in the inpatient setting and are less relevant to today’s practice patterns of short hospital stays followed by outpatient rehabilitation. Current postoperative rehabilitation protocols differ considerably from when the largest body of evidence was collected, making it difficult to apply the available evidence to the present situation. For use of CPM after TKA, recent studies have suggested that institutional and home use of CPM has no benefit compared to standard PT. There were no studies evaluating CPM in patients who cannot perform standard PT. The evidence is insufficient to determine the effects of the technology on health outcomes.
For individuals who have intra-articular cartilage repair of the knee who receive CPM in the home, the evidence includes nonrandomized studies, case series, and studies with nonclinical outcomes (e.g., histology). Relevant outcomes are symptoms and functional outcomes. Systematic reviews of CPM for this indication cite studies reporting better histologic outcomes in patients following CPM. A few studies have reported clinical outcomes, but inadequacies of these studies do not permit conclusions of efficacy. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have other musculoskeletal conditions requiring PT who receive CPM in the home, the evidence includes RCTs for some conditions and only case series for others. Relevant outcomes are symptoms and functional outcomes. Three small RCTs of CPM after rotator cuff surgery showed some evidence that CPM after rotator cuff repair of the shoulder improves short-term pain and range of motion; however, the studies were not of high quality, and the small differences in outcomes may not be clinically important. Two of these trials reported short-term improvements in range of motion for patients undergoing CPM, and 1 reported a short-term reduction in pain. None reported long-term improvements, and there are no reported benefits in functional status. Therefore, the clinical significance of the short-term improvements reported is uncertain. In addition, there is uncertainty about the optimal PT regimen following shoulder surgery such that the optimal comparison for CPM is unclear. For other conditions, RCTs do not exist; case series did not show efficacy of CPM or had important methodologic flaws. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals who have had a stroke requiring PT who receive CPM in the home setting, the evidence includes 1 small RCT. Relevant outcomes are symptoms and functional outcomes. This trial reported a trend toward improved shoulder joint stability, but no statistical difference between CPM plus PT compared to PT alone. The trial was small and treatment lasted only 20 days. The evidence is insufficient to determine the effects of the technology on health outcomes.

CLINICAL INPUT RECEIVED THROUGH PHYSICIAN SPECIALTY SOCIETIES AND ACADEMIC MEDICAL CENTERS

While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

2016 Input
In response to requests for input on the use of CPM following knee intra-articular repair procedures, input was received from 2 physician specialty societies and 1 academic medical center while this policy was under review in 2016. Input agreed that CPM is considered medically necessary as an adjunct to PT during the non-weight-bearing rehabilitation period following intra-articular cartilage repair procedures of the knee. One reviewer referred to the 2015 American Academy of Orthopaedic Surgery guidelines on the surgical management of osteoarthritis of the knee, which concluded that there was strong evidence that CPM after knee arthroplasty does not improve outcomes.

2010
In response to requests, input was received from 2 physician specialty societies and 5 academic medical centers while this policy was under review in 2010. Overall, clinical input supported the
use of CPM under conditions of low postoperative mobility or inability to comply with rehabilitation exercises following a TKA or TKA revision or during the non-weight-bearing rehabilitation period following intra-articular cartilage repair procedures of the knee. Support was limited for use of CPM in joints other than the knee, or in situations/conditions other than those described in this policy.

2008
In response to requests, input was received from 1 physician specialty society and 2 academic medical centers while this policy was under review in 2008. The 3 reviewers interpreted the existing literature as providing support for the use of CPM for the knee for at least 7 days postoperatively, whether in the hospital or home, and suggested that longer use of CPM would be warranted for special conditions.

PRACTICE GUIDELINES AND POSITION STATEMENTS
American Academy of Orthopaedic Surgeons
The American Academy of Orthopaedic Surgeons (AAOS) published evidence-based guidelines on the surgical management of osteoarthritis of the knee in 2015. AAOS identified 2 high-quality studies and 5 moderate-quality studies that evaluated the use of CPM. In 1 high-quality study, CPM was used for about 2 weeks after discharge. AAOS concluded that, “the combined results provide strong evidence that the surgical outcomes for those who used continuous passive motion are not better than for those who did not use continuous passive motion.”

French Physical Medicine and Rehabilitation Society
Clinical practice guidelines from the French Physical Medicine and Rehabilitation Society conclude that evidence is not sufficient to recommend substituting CPM for other rehabilitation techniques aimed at early mobilization after TKA. The evidence review found no positive effect of CPM over intermittent early mobilization, at short- or long-term follow-up.

U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS
Not applicable.

ONGOING AND UNPUBLISHED CLINICAL TRIALS
Some currently unpublished trials that might influence this review are listed in Table 2.

Table 2. Summary of Key Trials

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
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<tr>
<td>Ongoing</td>
<td>Preservation of Joint Function Using Postoperative Continuous Passive Motion (CPM): A Pilot Study</td>
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<td>Dec 2018</td>
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</table>

NCT: national clinical trial.

CODING
The following codes for treatment and procedures applicable to this policy are included below for informational purposes. Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement. Please refer to the member’s contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.
HCPCS
E0935 Continuous passive motion exercise device for use on knee only
E0936 Continuous passive motion exercise device for use other than knee
E1399 Durable medical equipment, miscellaneous

ICD-9 Diagnoses
These diagnoses are otherwise subject to medical policy as stated above
715.14 Osteoarthrosis, localized, primary; hand
715.16 Osteoarthrosis, localized, primary; lower leg
715.34 Localized osteoarthrosis not specified whether primary or secondary, hand
715.36 Localized osteoarthrosis not specified whether primary or secondary; lower leg
715.94 Osteoarthrosis, unspecified whether generalized or localized; hand
715.96 Osteoarthrosis, unspecified whether generalized or localized lower leg
716.14 Traumatic arthropathy; hand
716.16 Traumatic arthropathy, lower leg
716.17 Traumatic arthropathy; ankle and foot
716.84 Other specified arthropathy; hand
716.86 Other specified arthropathy, lower leg
716.87 Other specified arthropathy; ankle and foot
717.83 Old disruption anterior cruciate ligament
V43.62 Organ or tissue replaced by other means; elbow
V43.63 Organ or tissue replaced by other means; wrist
V43.65 Organ or tissue replaced by other means, Knee
V43.66 Organ or tissue replaced by other means, ankle

ICD-10 Diagnoses (Effective October 1, 2015)
M07.641 Enteropathic arthropathies; right hand
M07.642 Enteropathic arthropathies; left hand
M07.661 Enteropathic arthropathies, right knee
M07.662 Enteropathic arthropathies, left knee
M07.671 Enteropathic arthropathies, right ankle and foot
M07.672 Enteropathic arthropathies, left ankle and foot
M12.541 Traumatic arthropathy; right hand
M12.542 Traumatic arthropathy; left hand
M12.561 Traumatic arthropathy, right knee
M12.562 Traumatic arthropathy, left knee
M12.571 Traumatic arthropathy, right ankle and foot
M12.572 Traumatic arthropathy, left ankle and foot
M12.841 Other specific arthropathies, not elsewhere classified; right hand
M12.842 Other specific arthropathies, not elsewhere classified; left hand
M12.861 Other specific arthropathies, not elsewhere classified, right knee
M12.871 Other specific arthropathies, not elsewhere classified, right ankle and foot
M12.872 Other specific arthropathies, not elsewhere classified, left ankle and foot
M17.0 Bilateral primary osteoarthritis of knee
M17.11 Unilateral primary osteoarthritis, right knee
M17.12 Unilateral primary osteoarthritis, left knee
M18.0 Bilateral primary osteoarthritis of first carpometacarpal joints
M18.11 Unilateral primary osteoarthritis of first carpometacarpal joint; right hand
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<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tr>
<td>M18.12</td>
<td>Unilateral primary osteoarthritis of first carpometacarpal joint; left hand</td>
</tr>
<tr>
<td>M19.041</td>
<td>Primary osteoarthritis; right hand</td>
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<tr>
<td>M19.042</td>
<td>Primary osteoarthritis; left hand</td>
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<tr>
<td>M23.51</td>
<td>Chronic instability of knee, right knee</td>
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<tr>
<td>M23.52</td>
<td>Chronic instability of knee, left knee</td>
</tr>
<tr>
<td>Z96.621</td>
<td>Presence of right artificial elbow joint</td>
</tr>
<tr>
<td>Z96.622</td>
<td>Presence of left artificial elbow joint</td>
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<tr>
<td>Z96.631</td>
<td>Presence of right artificial wrist joint</td>
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<tr>
<td>Z96.632</td>
<td>Presence of left artificial wrist joint</td>
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<tr>
<td>Z96.651</td>
<td>Presence of right artificial knee joint</td>
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<td>Z96.652</td>
<td>Presence of left artificial knee joint</td>
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<tr>
<td>Z96.653</td>
<td>Presence of artificial knee joint, bilateral</td>
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<tr>
<td>Z96.659</td>
<td>Presence of unspecified artificial knee joint</td>
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<tr>
<td>Z96.661</td>
<td>Presence of right artificial ankle joint</td>
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<tr>
<td>Z96.662</td>
<td>Presence of left artificial ankle joint</td>
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**REVISIONS**

<table>
<thead>
<tr>
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| 03-08-2010   | - Revised wording in C. From: "The use of a CPM device for any primary or adjunct therapeutic application other than those listed above is considered investigational/ not medically necessary."  
               | To: "The use of a CPM device for any primary or adjunct therapeutic application other than those listed above is considered experimental / investigational."  
               | - Revised wording in A., third paragraph from: "CPM is approved without review-for a rental period no longer than 21 days from date of first application."  
               | To: "If CPM is approved, allow for a rental period no longer than 21 days from date of first application."                                                                                                      |

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<thead>
<tr>
<th>Date</th>
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<tr>
<td></td>
<td>- Added HCPCS Code: E0936 (effective 01-01-07)</td>
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<tr>
<td>03-07-2012</td>
<td>- In Item A, #1, removed “TKA” at the end to read “or revision.”</td>
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<tr>
<td></td>
<td>- In Item A, added “#2. Partial knee arthroplasty (27446)”</td>
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<tr>
<td></td>
<td>- In Item A, added the following:</td>
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<tr>
<td></td>
<td>- 6. Osteochondral grafting</td>
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<td></td>
<td>- 7. Treatment of osteochondritis dissecans</td>
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<td></td>
<td>- 8. Repair of tibial plateau fractures</td>
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<td></td>
<td>Updated the Rationale section.</td>
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<td></td>
<td>Updated the Reference section.</td>
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<tr>
<td>09-17-2013</td>
<td>- Added ICD-10 Diagnosis codes (Effective October 1, 2014)</td>
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<tr>
<th>Date</th>
<th>Policy title revised from “Continuous Passive Motion for Home Use”</th>
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<tbody>
<tr>
<td>09-29-2015</td>
<td>Updated Description section.</td>
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<tr>
<td>09-16-2016</td>
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</table>
In Policy section section:
- Policy language previously stated, "A. Continuous passive motion (CPM) is considered medically necessary for the following surgeries:
  1. Total knee arthroplasty (TKA) or revision
  2. Partial knee arthroplasty
  3. Anterior cruciate ligament (ACL) repair
  4. Autologous chondrocyte implantation (ACI)
  5. Microfracture of the knee
  6. Osteochondral grafting
  7. Treatment of osteochondritis dissecans
  8. Repair of tibial plateau fractures
Continuous passive motion (CPM) will be reviewed for medical necessity for the following surgeries:
  1. Ankle
  2. Elbow
  3. Wrist
  4. Hand
If CPM is approved, allow for a rental period no longer than 21 days from date of first application.
B. Continuous passive motion (CPM) is denied not medically necessary for the following surgeries:
  1. Shoulder
  2. Interphalangeal joints of lower extremities to include the great toe
C. The use of a CPM device for any primary or adjunct therapeutic application other than those listed above is considered experimental / investigational."
- Current policy language states, "A. Use of continuous passive motion (CPM) in the home setting may be considered medically necessary as an adjunct to physical therapy in the following situations:
  1. Under conditions of low postoperative mobility or inability to comply with rehabilitation exercises following a total knee arthroplasty (TKA) or TKA revision. This may include patients with complex regional pain syndrome (reflex sympathetic dystrophy); extensive arthrofibrosis or tendon fibrosis; or physical, mental, or behavioral inability to participate in active physical therapy.
  2. During the non-weight-bearing rehabilitation period following intra-articular cartilage repair procedures of the knee (eg, microfracture, osteochondral grafting, autologous chondrocyte implantation, treatment of osteochondritis dissecans, repair of tibial plateau fractures.
B. Use of CPM in the home setting for all other conditions is considered not medically necessary.
Policy Guidelines
1. If CPM is approved, allow for a rental period no longer than 21 days from date of first application."
REFERENCES


Other References
1. Blue Cross and Blue Shield of Kansas Orthopedic Liaison Committee, January 10, 2007 (see Blue Cross and Blue Shield of Kansas Newsletter, Blue Shield Report. MAC–01-07).
2. Blue Cross and Blue Shield of Kansas Medical Advisory Committee meeting, April 19, 2007 (see Blue Cross and Blue Shield of Kansas Newsletter, Blue Shield Report. MAC–01-07).