01.01.04 Continuous Passive Motion (CPM) Devices in the Home Setting

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Related Policies:

- None

Summary

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.

Summary of Evidence

For individuals who have total knee arthroplasty (TKA) who receive continuous passive motion (CPM) in the home setting, the evidence includes randomized controlled 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 available evidence to the present situation. For use of CPM after TKA, recent studies have suggested that institutional and home use of CPM did not show improved outcomes compared with standard physical therapy (PT). There were no studies evaluating CPM in individuals who could not perform standard PT. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome. However, even though there is a paucity in the peer-reviewed scientific evidence in showing consistent evidence regarding the effectiveness of CPM for individuals who have TKA who receive CPM in the home setting, for certain carefully-selected individuals the use of CPM will be considered medically necessary when the criteria below are met, see Policy.

For individuals who have articular cartilage repair of the knee who receive CPM in the home setting, the evidence includes nonrandomized studies, case series, and studies with nonclinical outcomes (e.g., histology), and systematic reviews of these studies. Relevant outcomes are symptoms and functional outcomes. Systematic reviews of CPM for this indication have cited studies reporting better histologic outcomes in individuals following CPM. A few studies have reported clinical outcomes, but inadequacies of these studies do not permit conclusions on efficacy. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome. However, even though there is a paucity in the peer-reviewed scientific evidence in showing consistent evidence regarding the effectiveness of CPM for individuals who have articular cartilage repair of the knee who receive CPM in the home setting, for certain carefully-selected individuals the use of CPM will be considered medically necessary when the criteria below are met, see Policy.

For individuals who have musculoskeletal conditions other than TKA or knee cartilage repair requiring PT who receive CPM in the home setting, the evidence includes systematic reviews and/or RCTs for some conditions and 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 this shoulder surgery improved short-term pain and range of motion (ROM); however, the trials were not high-quality, and the small differences in outcomes may not be clinically important. Two trials reported short-term improvements in ROM for individuals undergoing CPM, and one 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 treatment comparator for CPM is unclear. A systematic review and two small RCTs compared CPM with conventional PT for treatment of adhesive capsulitis. The systematic review concluded that continuous passive motion may be effective in the short-term. One of the trials focused on diabetic patients with adhesive capsulitis. Both reported comparable improvements in range of motion and functional ability between treatment groups. Although no RCTs of CPM in the home setting after repair of the anterior cruciate ligament were identified, indirect evidence from RCTs conducted in the inpatient immediate postoperative setting following anterior cruciate ligament repair indicated no additional benefit with CPM compared to conventional PT. One small RCT in humeral fractures also found short-term benefits of continuous passive motion, but by 3 months there was no significant difference between groups. For other musculoskeletal conditions, RCTs do not exist; case series either did not show efficacy of CPM or had important methodologic flaws. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

For individuals who have had a stroke requiring PT who receive CPM in the home setting, the evidence includes 2 small RCTs. Relevant outcomes are symptoms and functional outcomes. These trials reported mixed results; 1 RCT indicated a non-significant trend toward improvement in shoulder joint stability with CPM and PT relative to PT alone, while the other indicated significant improvement in functional outcomes related to wrist movement and global upper extremity movement symptoms with CPM plus conventional therapy relative to conventional therapy alone. Both trials were small, and treatment lasted only 20 days in the shoulder joint study. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

Additional Information

2010 Input

For patients unable to tolerate exercise regimens following total knee arthroplasty, continuous passive motion is an alternative modality. However, there is no evidence to support its use in this situation. Clinical input obtained in 2010 supports the use of continuous passive motion under conditions of low postoperative mobility or inability to comply with rehabilitation exercises following a total knee arthroplasty or total knee arthroplasty revision.

2016 Input

Despite a lack of published evidence, clinical input obtained in 2016 supports the use of continuous passive motion after articular cartilage repair of the knee.

OBJECTIVE

The objective of this evidence review is to determine whether continuous passive motion (CPM) improves the net health outcome in individuals undergoing postsurgical rehabilitation in the home setting.

PRIOR APPROVAL

Not applicable.

POLICY

***Note**: If the* continuous passive motion *(CPM) device is determined to be medically necessary, the CPM device is payable only as rental equipment for 30 days following surgery.*

Continuous Passive Motion (CPM) Device for the Knee

The use of continuous passive motion (CPM) device in the home setting may be considered **medically necessary** for the below indications as an alternative to physical therapy (PT) when the individual has low postoperative mobility or inability to comply with rehabilitation exercises (this may include individuals 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):

- Following total knee arthroplasty (TKA) (replacement or revision) or following partial knee replacement; **or**
- Following intra-articular cartilage repair procedures of the knee (e.g., microfracture, osteochondral grafting, autologous chondrocyte implantation, treatment of osteochondritis dissecans, repair of tibial plateau fractures, ACL reconstruction)

All other uses of CPM device of the knee in the home setting not meeting the above criteria is considered **not medically necessary**, because the available published peer reviewed scientific evidence regarding the use of CPM has not been proven to provide equivalent or superior benefit compared to conventional PT.

Duplicate Rehabilitative Therapy

Duplicate rehabilitative therapy is considered **not medically necessary,** see Policy Guidelines.

Continuous Passive Motion (CPM) Device for Other than the Knee

The use of CPM device in the home setting for any joint other than the knee for all conditions is considered **investigational** because the evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

POLICY GUIDELINES

Note: *The literature suggests that institutional and home use of CPM has minimal benefit alone or when combined with standard physical therapy (PT) after total knee arthroplasty (TKA), total knee arthroplasty (TKA) revision or intra-articular cartilage repair. For individuals who are unable to participate in standard PT regimens (due to low post-operative mobility or inability to comply with rehabilitation exercises), CPM remains as an alternative PT modality.*

Duplicative Rehabilitative Therapy

When individuals are receiving PT, the therapist should provide different treatments and not duplicate the same treatment (i.e., CPM provides ROM (range of motion), and PT protocols also typically include ROM treatment/services).

Coding

See the Codes table for details.

BACKGROUND

Physical therapy (PT) of joints following surgery focuses both on passive motion to restore mobility and on active exercises to restore strength. While passive motion can be administered by a therapist, CPM devices have also been used. CPM is thought to improve recovery by stimulating the healing of articular tissues and the circulation of synovial fluid; reducing local edema; and preventing adhesions, joint stiffness or contractures, or cartilage degeneration. CPM has been investigated primarily in the knee, particularly after TKA or ligamentous or cartilage repair. Acceptance of its use in the knee joint has created interest in continuous passive motion use for other weight-bearing joints (i.e., hip, ankle,

metatarsals) as well as non-weight-bearing joints (i.e., shoulder, elbow, metacarpals, interphalangeal joints). Use of CPM in stroke and burn individuals is also being explored.

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

Over time, hospital lengths of stay have progressively shortened, and, in some cases, surgical repair is done 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 range of motion from an intensive in-hospital program to a less intensive outpatient program. Some providers may want patients to continue continuous passive motion in the home setting as a means of duplicating services offered with a longer (7-day) hospital stay.

The focus of the current review is to examine the literature on the use of CPM in the home setting as it is currently being prescribed postoperatively. Relevant comparisons are treatment outcomes of CPM when used alone or with physical therapy, compared with physical therapy alone.

Regulatory Status

Continuous passive motion (CPM) devices are considered class 1 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 regarding efficacy but only notification of the FDA before marketing. Food and Drug Administration product code: BXB.

RATIONALE

This evidence review was created in December 2003 and has been updated regularly with searches of the PubMed database. The most recent literature update was performed through May 2025.

Evidence reviews assess the clinical evidence to determine whether the use of technology improves the net health outcome. Broadly defined, health outcomes are the length of life, quality of life, and ability to function including benefits and harms. Every clinical condition has specific outcomes that are important to individuals and managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is a balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of technology, two domains are examined: the relevance, and quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less

common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

Total Knee Arthroplasty

Clinical Context and Therapy Purpose

The purpose of continuous passive motion (CPM) in the home setting in individuals with total knee arthroplasty (TKA) is to provide a treatment option that is an alternative to or an improvement on existing therapies.

Populations

The relevant population(s) of interest are individuals with TKA.

Interventions

The therapy being considered is CPM.

Comparators

The following therapies are currently being used for TKA: Physical therapy (PT) alone or standard of care, if unable to tolerate PT.

Outcomes

The general outcomes of interest are symptoms and functional outcomes.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.
- Consistent with a 'best available evidence approach,' within each category of study design, studies with larger sample sizes and longer durations were sought.
- Studies with duplicative or overlapping populations were excluded.

Review of Evidence

Systematic Review

Hayes Inc. completed a Health Technology Assessment (March 2022) regarding continuous passive motion (CPM) for knee indications that reviewed evidence for prevention of contracture after total knee arthroplasty (TKA) surgery, anterior cruciate ligament (ACL) repair and for all other knee indications. Reviewers searched PubMed, Embase and gray literature and identified one systematic review assessing 24 RCTs (Harvey et al 2014), along with 5 subsequently RCTs published (Boese 2014, Herbold 2014,

Alaca 2015, Baloch 2015, Joshi 2015) with 3 of these studies addressing the use of CPM following ACL repair (Rosen 1992, McCarthey 1993, Engstrom 1995). The overall quality of evidence for TKA and use of CPM is considered moderate regarding the key outcomes related to ROM, function and quality of life (QOL) which found no significant benefit from CPM compared to conventional PT alone. The evidence on the use of CPM following ACL repair is considered low quality which found no benefit in ROM. There were no RCTs found using CPM after ACL reconstruction published after 1995 identified, suggesting the use of CPM for this indication may have waned. Limitations included almost all reviewed studies used CPM on an inpatient basis, treatment protocols were inconsistent, and patient characteristics varied in age and gender for TKA versus ACL repair to include study inclusion and exclusion criteria being generally inclusive and not strictly followed. Professional organizations, including American Academy of Orthopedic Surgeons and American Physical Therapy Association do not endorse the use of CPM.

For use of CPM in prevention of contracture for all other knee indications, the reviewers found a paucity of evidence for the use of CPM as there was insufficient published peer reviewed medical literature to assess the safety and efficacy on health outcomes or patient management.

Randomized Controlled Trials

A study by Worland et al (1998) compared the use of continuous passive motion with active PT in the home setting. At discharge, they randomized 80 patients undergoing total knee arthroplasty to home continuous passive motion (3 hours/day for 10 days) or to active PT. Most studies have examined continuous passive motion as an adjunct to active PT, while this study proposed continuous passive motion as an alternative to PT. At 2 weeks, knee flexion was similar in both groups, but a flexion contracture was noted in 1 patient in the continuous passive motion group. At 6 months, no differences were found in knee scores or knee flexion.

In another RCT, Lenssen et al (2008) evaluated 60 patients with limited flexion range of motion (<80) at the time of hospital discharge who were assigned to standard PT alone or PT plus continuous passive motion in the home (4 hours/day) until assessment on postoperative day 17. Blinded assessment showed a trend for increased range of motion for the continuous passive motion group (eg, 89 vs. 84, respectively ; p=.07), with no differences in function between groups, as measured by the Knee Society Score (function subscore 43 vs. 40, respectively) and the Western Ontario and McMaster Universities Osteoarthritis Index difficulty score (49 vs. 45, respectively). No differences were observed between groups in range of motion or function at the 6-week or 3-month assessment. In addition, no differences were observed for the secondary outcome measures (perceived effect, medication use, satisfaction with treatment, adherence) at either of the assessment times.

Section Summary: Total Knee Arthroplasty

Early trials comparing CMP as adjunctive therapy with PT for individuals undergoing TKA were generally 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 available evidence to the present situation. For use of CPM after TKA, recent studies have suggested that institutional and home use of CPM did not show improved outcomes compared with standard PT. There were no studies evaluating CPM in individuals who could not perform standard PT.

Articular Cartilage Repair of the Knee

Clinical Context and Therapy Purpose

The purpose of CPM in the home setting in individuals with articular cartilage repair of the knee is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The following PICO was used to select literature to inform this review.

Populations

The relevant population(s) of interest are individuals with articular cartilage repair of the knee.

Interventions

The therapy being considered is CPM.

Comparators

The following therapies are currently being used for articular cartilage repair of the knee: standard of care.

Outcomes

The general outcomes of interest are symptoms and functional outcomes.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.
- Consistent with a 'best available evidence approach,' within each category of study design, studies with larger sample sizes and longer durations were sought.
- Studies with duplicative or overlapping populations were excluded.

Review of Evidence

Although no RCTs were identified comparing health outcomes with or without the use of continuous passive motion, continuous passive motion is routinely used as part of the rehabilitation protocol for as long as 6 weeks when weight-bearing is restricted following autologous chondrocyte implantation. Basic research supports the use of continuous passive motion to facilitate greater healing of articular cartilage of full-thickness defects that penetrate the subchondral bone compared with either immobilization or intermittent mobilization.

Fazalare et al (2010) published a systematic review of continuous passive motion after knee cartilage defect surgery. Reviewers found that continuous passive motion had been used following autologous chondrocyte implantation, microfracture, and osteochondral autografts in numerous studies in the previous 5 years. Four level III (cohort) studies with 262 patients were identified that compared continuous passive motion with no continuous passive motion; no RCTs were identified. Procedures in these 4 studies included microfracture, periosteal transplant of the patella, and high tibial osteotomy with diagnostic arthroscopy or abrasion arthroplasty. Continuous passive motion regimens ranged from 6 days to 8 weeks. Heterogeneity in the studies and outdated surgical techniques limited conclusions drawn from these trials. Clinical outcomes did not permit a definitive conclusion of efficacy of continuous passive motion. However, reviewers cited several studies in which other outcomes (e.g., histologic outcomes on follow-up biopsies) did favor continuous passive motion.

Another systematic review by Howard et al (2010) evaluated continuous passive motion and other postoperative practices after knee cartilage repair. Reviewers cited several basic science studies using animal models that appear to support continuous passive motion. They identified 2 clinical studies, both of which were retrospective nonrandomized comparative studies. In 1 study (N =43), 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 continuous passive motion group (n=46) had greater improvement in grading of the cartilage lesion compared with patients who did not have access to continuous passive motion (n=31).

See Hayes Inc. Systematic Review under Total Knee Arthroplasty above.

Section Summary: Articular Cartilage Repair of the Knee

Current evidence on use of CPM to facilitate knee rehabilitation after articular cartilage repair includes systematic reviews. These reviews reported methodologic issues with available cohort studies and a paucity of studies assessing clinical application of CPM to knee rehabilitation.

Other Musculoskeletal Conditions Requiring Physical Therapy

Clinical Context and Therapy Purpose

The purpose of CPM in the home setting in individuals with musculoskeletal conditions other than total knee arthroplasty or knee cartilage repair requiring PT is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The following PICO was used to select literature to inform this review:

Populations

The relevant population of interest is individuals with musculoskeletal conditions other than total knee arthroplasty or knee cartilage repair requiring PT.

Interventions

The therapy being considered is CPM.

Comparators

The following therapies are currently being used for musculoskeletal conditions other than total knee arthroplasty or knee cartilage repair requiring PT: standard of care.

Outcomes

The general outcomes of interest are symptoms and functional outcomes.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.
- Consistent with a 'best available evidence approach,' within each category of study design, studies with larger sample sizes and longer durations were sought.
- Studies with duplicative or overlapping populations were excluded.

Review of Evidence

Articular Knee Fractures

Hill et al (2014) randomized 40 patients with articular fractures of either the proximal part of the tibia or the distal end of the femur to standardized PT with or without continuous passive motion for 48 hours postoperatively. At the 48-hour assessment, the continuous passive motion group had significantly greater knee flexion (43 difference; p<.005). However, 6 of 20 patients were unable to tolerate continuous passive motion and there was no benefit to adding 48 hours of continuous passive motion when assessed at any of the follow-up visits (2, 6, 12, and 24 weeks).

See Hayes Inc. Systematic Review under Total Knee Arthroplasty above.

Anterior Cruciate Ligament Repair

This literature review did not identify any RCTs of continuous passive motion in the home setting after repair of the anterior cruciate ligament. However, the studies of continuous passive motion after anterior cruciate ligament repair in the immediate postoperative period may be relevant to the non-acute care hospital or home setting for patients discharged following a shorter hospital stay. The TEC Assessment (1997) concluded that continuous passive motion as an adjunct to conventional PT in the immediate postoperative period after anterior cruciate ligament repair offered no demonstrable advantage over conventional PT alone. In a systematic review of anterior cruciate ligament reconstruction rehabilitation, Wright et al (2008) discussed 6 RCTs on continuous passive motion published before 1996; no RCTs published after the 1997 TEC Assessment were identified. Reviewers found no substantial advantage for continuous passive motion use and concluded that continuous passive motion for anterior cruciate

ligament rehabilitation could not be justified. Wright et al (2008) also noted that most current anterior cruciate ligament rehabilitation protocols initiate early motion within the first postoperative week.

A 2022 review was conducted to synthesize evidence from systematic reviews for rehabilitation interventions following anterior cruciate ligament injury. This review identified 1 systematic review that included evidence for continuous passive motion by Gatewood et al (2017). The authors identified 2 RCTs of continuous passive motion in the immediate postoperative setting, 1 of which was not included in the review by Wright et al (2008). In this study, 60 patients (95% of whom were men) were randomized to use of a continuous active motion device or continuous passive motion device for 7 days, beginning on postoperative day 1. No difference was identified between groups in knee range of motion or pain at postoperative day 7. Patients in the continuous active motion group demonstrated a significant improvement in joint position sense (measured by passive angle reproduction) relative to the continuous passive motion group at postoperative day 7, with a between-group difference of 2.2 degrees.

See Hayes Inc. Systematic Review under Total Knee Arthroplasty above.

Rotator Cuff Repair

Systematic Review

Hayes Inc. completed a Health Technology Assessment (May 2022) on continuous passive motion (CPM) devices for shoulder indications that included the use of CPM after rotator cuff repair for prevention of shoulder joint contracture and as an adjunct to physical therapy (PT) in patients with joint contracture (adhesive capsulitis). The reviewers searched PubMed and Embase and identified six RCTs (Raab 1996, Lastayo 1998, Michael 2005, Garofalo 2010, Arndt 2012, Lee 2012) and two RCTs (Dundar 2009, Ekim 2016) addressing the use of CPM for the treatment of adhesive capsulitis were included. While low-quality evidence found some possible benefits of CPM when used as adjunct to PT in patients with rotator cuff repair questions remained regarding the long-term effectiveness $\geq$ 3 weeks of CPM. This is because as none of the trials reported any significant improvements in functional status compared with PT alone and it was unclear whether the observed short-term improvement was clinically meaningful. Regarding strength and pain CPM resulted in similar or better outcomes compared with PT only but functional outcomes were mixed. For patients with adhesive capsulitis evidence from 2 very low quality RCTs found that 4-weeks of CPM improved pain compared with PT alone, as well as ROM and function. Limitations included heterogeneity across PT comparator treatments and rehabilitation treatment protocols, small sample sizes and lack of long term follow-up.

Du Plessis et al (2011) published a systematic review of continuous passive motion following rotator cuff repair.[1] Three RCTs were included, though meta-analysis could not be conducted due to heterogeneity across trials. Two of the RCTs, by Lastayo et al (1998) and Raab et al (1996) are discussed below. The third trial was a German-language report by Michael et al (2005) 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.

Randomized Controlled Trials

The trial by Lastayo et al (1998) randomized 31 patients undergoing rotator cuff repair to a 4-week home program of continuous passive motion (average, 3 hours/day) 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 continuous passive motion. Patients were evaluated with preoperative and 3-month postoperative shoulder scores that

included pain, function, muscle strength, and range of motion. A statistically significant improvement was found in range of motion for those receiving continuous passive motion, although there was no significant improvement in overall shoulder score between groups. Both of these RCTs were likely under powered to show differences on important clinical outcomes.

Garofalo et al (2010) reported on a randomized trial assessing the effects of continuous passive motion after rotator cuff repair. During weeks 1 to 4 post surgery, all 100 patients underwent passive self-assisted range of motion exercise, with half of the patients also receiving continuous passive motion for 4, 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 post surgery, all patients underwent the same PT protocol. Visual analog scale ratings for pain were measured at 2.5, 6, and 12 months by an independent examiner. Between groups, visual analog scale ratings were slightly better for patients who received continuous passive motion 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. Range of motion was significantly better in the group receiving continuous passive motion 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 continuous passive motion following rotator cuff surgery were identified in the English-language literature. Two of these trials reported short-term improvements in range of motion for patients undergoing continuous passive motion, and one 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, so the optimal comparator for continuous passive motion is not clear.

Adhesive Capsulitis of the Shoulder

Systematic Review

Baradaran et al (2023) conducted a systematic review of continuous passive motion compared to PT in patients with primary adhesive capsulitis (Tables 1 through 3). A total of 5 studies were included in the meta-analysis, but the conclusions were limited by heterogeneity. The authors concluded that continuous passive motion may be slightly effective in the short-term, but that long-term efficacy is still unknown.

Table 1. Trials/Studies Included in Systematic Review and Meta-Analysis

Study	Baradaran et al (2023)
Azizi et al (2018)	●
Ekim et al (2016)	●
Chung et al (2015)	●
Chen et al (2009)	●
Dundar et al (2009)	●

Table 2. Systematic Review and Meta-Analysis Characteristics

Study	Dates	Trials	Participants	N (Range)	Design	Duration
Baradaran et al (2023)	2009-2018	5	224	16-80	RCT	4-24 weeks

Table 3. Systematic Review and Meta-Analysis Results

Study	Pain at movement	Pain at rest	SPADI score	Constant functional shoulder score
Baradaran et al (2023)				
Total N	114	114	178	128
Pooled effect (95% CI)	Short-term[1]: -1.277 (-2.146 to -0.407) Long-term[2]: -1.222 (-2.224 to -0.220)	Short-term[1]: -0.872 (-1.784 to 0.040) Long-term[2]: -0.816 (-1.704 to 0.073)	Short-term[1]: -5.196 (-12.995 to 2.602) Long-term[2]: -4.561 (-12.976 to 3.855)	Short-term[1]: 4.117 (-1.622 to 9.857) Long-term[2]: 4.790 (0.376 to 9.204)
p	Short-term[1]: .004 Long-term[2]: .017	Short-term[1]: .061 Long-term[2]: .072	Short-term[1]: .192 Long-term[2]: .288	Short-term[1]: .160 Long-term[2]: .033

CI: confidence interval; SPADI: shoulder pain and disability index.
[1]Short-term was defined as outcomes at week 4.
[2] Long-term was defined as outcomes at week 12, or pooled outcomes from weeks 8 and 24 (depending on the study).

See Hayes Inc. Systematic Review above under Rotator Cuff Repair.

Randomized Controlled Trials

Dundar et. al. compared continuous passive motion (CPM) with physical therapy (PT) in a randomized trial of 57 patients with adhesive capsulitis (frozen shoulder). CPM or PT was provided for 1 hour a day (5 days/week) for 4 weeks. Pain and function levels were similar in the 2 groups at baseline, with VAS (visual analog) scores for pain ranging from 5.44 (at rest) to 6.34 (with movement). Assessments at baseline, 4, and 12 weeks showed reductions in pain and improvements in 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 (range of motion) or function. This trial provided modest support for the inclusion of CPM in a PT regimen for this patient population.

A randomized controlled trial (RCT) by Ekim et. al. (2016) compared continuous passive motion (CPM) (n=20) with physical therapy (PT) (n=21) for the treatment of adhesive capsulitis in patients who had diabetes. CPM or PT was provided for 1 hour a day (5 days/week) 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 range of motion

(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.

Hip Osteoarthritis

One older pilot study (1999) examined the use of continuous passive motion in patients with hip osteoarthritis in the absence of surgical intervention.[40,] In this uncontrolled study, continuous passive motion 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.

Femoral Fracture

Olasinde et al (2023) reported the results of a randomized trial that compared continuous passive motion to PT in patients who underwent retrograde femoral nailing for femoral fracture.[41,] The 88 participants were randomized to continuous passive motion or conventional PT, each for 2 hours daily. Knee stiffness at weeks 1, 2, and 6 were significantly lower among patients who received continuous passive motion compared to patients who received conventional PT (all $p<.0001$). Pain scores (measured by visual analogue scale) were significantly lower for the first 7 days in the continuous passive motion group, and total arc of motion gained postoperatively was also significantly larger at postoperative weeks 1, 2, and 6 (all $p<.05$). Interpretation of these results is limited because the duration of the intervention was not clearly stated.

Elbow Contracture

Postoperative management of open elbow contracture release with continuous passive motion (CPM) was assessed in a matched cohort study by Lindenhovius et. al. Sixteen patients who had used CPM after open contracture release and 16 patients who had not were matched by age, sex, diagnosis, range of motion (ROM) and radiographic appearance. Improvements in ROM did not differ between groups at the early range of 4-10 months and the final range of 11–56-month evaluation. The authors concluded the "matched retrospective data did not demonstrate a benefit of CPM in the postoperative management of elbow contracture release."

Based on a review by Viveen et.al. (2017) to date there have been no prospective randomized trials comparing rehabilitation protocols after surgery release of stiff elbow. Based upon current scientific literature, "there is no clear preference for one of the treatments over the other (CPM or PT) regarding the increase of ROM after surgery. CPM in elbow surgery may be redundant as well as in other joints, the use of CPM as a post treatment seems ineffective and unnecessary."

Hand Repair

In 1997, the TEC Assessment reviewed a multicenter study of continuous passive motion in patients who had undergone flexor tendon repair and found the data inadequate to permit scientific conclusions about continuous passive motion application.

Ring et al (1998) conducted a randomized trial that examined the role of continuous passive motion in patients undergoing silicone interposition arthroplasty of the metacarpophalangeal joints secondary to rheumatoid arthritis. Patients were randomized to a 6-week protocol of continuous passive motion (10 hands [40 joints]) or to a standard dynamic splint protocol (15 hands [60 joints]). The trial did not show better outcomes in the continuous passive motion group.

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

Foot Repair

One study (2005) has compared continuous passive motion with immobilization following surgical treatment of idiopathic club foot in 37 infants (50 feet). The infants were randomized to continuous passive motion (4 hours/day) or to casting during days 10 to 42 following surgery. Blinded analysis showed improvements in the Dimeglio Clubfoot Score with continuous passive motion (range of motion, 9.7 to 3.1) that were significantly greater than those in the control group (range of motion, 10.3 to 4.2) through 12 months (97% follow-up). Between 12 and 18 months, this trend reversed and by 48 months post-surgery, there was no significant difference between groups. Another study (2007) by the same group reported low compliance with this treatment.

Back Pain

An RCT by Gavish et al (2015) evaluated a continuous passive motion 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 with 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.

Wrist and Ankle Repair

There is a scarcity of peer reviewed evidence on the use of CPM postoperatively for the wrist and ankle. RCTs comparing the use of CPM to PT to improve range of motion are needed to determine whether the use of CPM provides clinically meaningful improvements in net health outcomes. The available published peer reviewed literature does not support the use of CPM postoperatively.

Humeral Fractures

An RCT by Tille et al (2024) evaluated a continuous passive motion device after plate osteosynthesis of proximal humeral fractures. A total of 95 patients were enrolled with 48 assigned to continuous passive motion and 47 without. Physical therapy was provided for all patients starting on day 7 postoperatively. Continuous passive motion was utilized 2 to 3 times daily for 6 weeks after surgery. After 6 weeks, there was a significantly better range of motion for forward flexion (90° with continuous passive motion vs. 80° in control; p=.035), adduction (30° with continuous passive motion vs. 30° with control; p=.049), and abduction (80° with continuous passive motion vs. 70° with control; p=.048) in the continuous passive motion group. There was no difference in other planes of motion. At 3 and 12 months of follow-up, the results between treatment groups were similar.

Section Summary: Other Musculoskeletal Conditions Requiring Physical Therapy

There is a wide range of studies assessing the use of CPM for musculoskeletal conditions other than TKA and knee cartilage repair. No RCTs of CPM conducted in the home setting after anterior cruciate ligament repair were identified; RCTs conducted in the immediate postoperative setting do not indicate clinical benefit with use of CPM compared to conventional PT. Three small RCTs of CPM after rotator cuff surgery showed some evidence that CPM after this shoulder surgery improved short-term pain and ROM; however, the trials were not high-quality, and the small differences in outcomes may not be clinically important. Two trials reported short-term improvements in ROM for individual undergoing CPM, and one

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 treatment comparator for CPM is unclear. A systematic review and two small RCTs compared CPM with conventional PT for treatment of adhesive capsulitis. The systematic review was limited by heterogeneity but concluded that CPM may be effective in the short-term. One of the trials focused on diabetic individuals with adhesive capsulitis. Both reported comparable improvements in ROM and functional ability between treatment groups. One small RCT in humeral fractures also found short-term benefits of continuous passive motion, but by 3 months there was no significant difference between groups. For other musculoskeletal conditions, RCTs do not exist; case series either did not show efficacy of CPM or had important methodologic flaws.

Stroke

Clinical Context and Test Purpose

The purpose of CPM in the home setting in individuals with stroke is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The following PICO was used to select literature to inform this review.

Populations

The relevant population of interest is individuals with stroke.

Interventions

The therapy being considered is CPM.

Comparators

The following therapies are currently being used for stroke: standard of care.

Outcomes

The general outcomes of interest are symptoms and functional outcomes.

Study Selection Criteria

Methodologically credible studies were selected using the following principles:

- To assess efficacy outcomes, comparative controlled prospective trials were sought, with a preference for RCTs;
- In the absence of such trials, comparative observational studies were sought, with a preference for prospective studies.
- To assess long-term outcomes and adverse events, single-arm studies that capture longer periods of follow-up and/or larger populations were sought.

- Consistent with a 'best available evidence approach,' within each category of study design, studies with larger sample sizes and longer durations were sought.
- Studies with duplicative or overlapping populations were excluded.

Review of Evidence

Continuous passive motion has been studied as a means to aid recovery of motor skills following stroke. One study (2005) randomized 35 patients to daily sessions of use of a shoulder joint continuous passive motion device (25 minutes) or to daily group therapy sessions consisting of self-directed shoulder range of motion 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 continuous passive motion group (n=17; p=.06) compared with the control group (n=15). No statistically significant differences were found for measures of motor impairment. This trial had a small sample size and short follow-up period, suggesting it may have had inadequate power to detect important differences in key outcomes.

In a 2022 randomized, single-blind crossover study, 18 patients aged 20 to 79 years with mild to severe arm-hand impairment following unilateral stroke were assigned (at least 6 months post-stroke) to undergo home-based therapy sessions twice daily, 5 days per week for 4 weeks, consisting of either task-specific motor training with an occupational therapist or home-based therapy with a robotic exoskeleton system combining continuous passive motion and robot-assisted gripping exercises. All patients received standard-of-care occupational therapy and PT for 2 hours per week. Crossover occurred following a 12-week washout. Patients initially assigned to the robotic exoskeleton intervention followed by task-specific motor training experienced significantly greater improvement in wrist extension range of motion at the end of treatment compared to those who received interventions in the opposite order. Assessments of manual dexterity and motor performance of the upper extremity were significantly improved following exoskeleton therapy, whereas no significant differences in these measures were noted following task-specific motor training. A significantly greater proportion of patients reported improvements in global symptoms after exoskeleton therapy (77%) than after task-specific motor training (11%).

Section Summary: Stroke

Two small, randomized trials (Lynch et. al 2005 and Kuo et al 2022) have reported mixed results with different CPM devices in combination with PT or occupational therapy (OT) compared to PT or OT alone in individuals who have experienced stroke, including a statistically non-significant trend toward improvement for the outcome of shoulder joint stability and significant improvements in wrist extension ROM, manual dexterity, and global symptoms related to upper extremity movement. Both trials were small, and treatment lasted only 20 days in the shoulder joint study by Lynch et a l (2005).

SUPPLEMENTAL INFORMATION

The purpose of the following information is to provide reference material. Inclusion does not imply endorsement or alignment with the evidence review conclusions.

Clinical Input Range of Motion Physician 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, input was received from 2 physician specialty societies and 1 academic medical center while this policy was under review in 2016. Input considered continuous passive motion (continuous passive motion) medically necessary as an adjunct to physical therapy during the non-weight-bearing rehabilitation period following articular cartilage repair procedures of the knee. One reviewer referred to the American Academy of Orthopaedic Surgery (2015) guidelines on the surgical management of osteoarthritis of the knee, which concluded that there was strong evidence that continuous passive motion after knee arthroplasty does not improve outcomes.

2010 Input

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, input supported the use of continuous passive motion under conditions of low postoperative mobility or inability to comply with rehabilitation exercises after total knee arthroplasty or total knee arthroplasty revision or during the non-weight-bearing rehabilitation period following articular cartilage repair procedures of the knee. Support was limited for use of continuous passive motion in joints other than the knee or in situations or conditions other than those described in this evidence review.

2008 Input

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 supporting the use of continuous passive motion for the knee for at least 7 days post operatively, whether in the hospital or home, and suggested that longer use of continuous passive motion would be warranted for special conditions.

Practice Guidelines and Position Statements

Guidelines or position statements will be considered for inclusion in ‘Supplemental Information' if they were issued by, or jointly by, a US professional society, an international society with US representation, or National Institute for Health and Care Excellence (NICE). Priority will be given to guidelines that are informed by a systematic review, include strength of evidence ratings, and include a description of management of conflict of interest.

American Academy of Orthopaedic Surgeons (AAOS)

Rotator Cuff Injuries

In 2019, the American Academy of Orthopaedic Surgeons (AAOS) updated their evidence based clinical practice guideline for the management of rotator cuff injuries, this guideline does not address use of continuous passive motion.

Osteoarthritis of the Hip

In 2023, the American Academy of Orthopaedic Surgeons (AAOS) updated their evidence based clinical practice guideline on the management of osteoarthritis of the hip, this guideline does not address use of continuous passive motion.

Carpal Tunnel Syndrome

In 2024, the American Academy of Orthopaedic Surgeons (AAOS) updated their evidence based clinical practice guideline for the management of carpal tunnel syndrome, this guideline does not address use of continuous passive motion (CPM).

Surgical Management of Osteoarthritis of the Knee

In 2015, the American Academy of Orthopaedic Surgeons (AAOS) published an evidence-based clinical practice guideline for the surgical management of osteoarthritis of the knee. The AAOS identified 2 high-quality studies and 5 moderate-quality studies that evaluated the use of continuous passive motion. In one high-quality study, continuous passive motion was used for about 2 weeks after discharge. The 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.”

The 2022 update of the AAOS guideline, which replaces the 2015 version, does not address use of continuous passive motion.

In 2020, the American Academy of Orthopaedic Surgeons expanded their Choosing Wisely® List of specific tests and procedures that orthopaedic surgeons and patients should question. “The Choosing Wisely® campaign, promotes conversation between clinicians and patients about utilizing the most appropriate, evidence-based tests and treatments, avoiding care whose harm may outweigh the benefits.” The AAOS expanded list includes the following: “Avoid routine use of continuous passive motion (CPM) after knee replacement.”

Glenohumeral Joint Osteoarthritis

In 2020, the American Academy of Orthopaedic Surgeons (AAOS) updated their evidence based clinical practice guideline on the management of glenohumeral joint osteoarthritis, this guideline does not address use of continuous passive motion.

Anterior Cruciate Ligament Injury

In 2022, the American Academy of Orthopaedic Surgeons (AAOS) updated their evidence based clinical practice guideline on the management of anterior cruciate ligament injuries, this guideline does not address the use of continuous passive motion.

Osteochondritis Dissecans

In 2023, the American Academy Orthopaedic Surgeons (AAOS) updated their evidence based clinical practice guideline on the diagnosis and treatment of osteochondritis dissecans, this guideline does not address use of continues passive motion.

American Physical Therapy Association

In 2020, the American Physical Therapy Association (APTA) published a clinical practice guideline on physical therapists' management of patients undergoing total knee arthroplasty. The APTA identified 4 high-quality studies, 6 moderate-quality studies, and 2 low-quality studies evaluating the effect of continuous passive motion devices on knee flexion and extension range of motion and need for manipulation under anesthesia, with moderate-quality studies indicating benefit with continuous passive motion contradicted by high-quality studies indicating no significant difference. Meta-analyses did not

indicate a significant impact of continuous passive motion on function or hospital length of stay. The APTA concluded that "physical therapists should NOT use CPMs [continuous passive motion devices] for patients who have undergone primary, uncomplicated TKA [total knee arthroplasty]."

Ongoing and Unpublished Clinical Trials

Some currently ongoing and unpublished trials that might influence this review can be located at clinicaltrials.gov.

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CODES

To report provider services, use appropriate CPT codes, HCPCS codes, Revenue codes, and/or ICD diagnosis codes.

Codes	Number	Description
CPT	None	
HCPCS		
	E0935	Continuous passive motion exercise device for use on knee only
	E0936	Continuous passive motion exercise device for use other than knee
Type of Service	Durable Medical Equipment	
Place of Service	Outpatient	

POLICY HISTORY

Date	Action	Action
May 2025	Annual Review	Policy Renewed
May 2024	Annual Review	Policy Revised
May 2023	Annual Review	Policy Revised
July 2022	Annual Review	Policy Renewed
July 2021	Annual Review	Policy Renewed

Date	Action	Action
July 2019	Annual Review	Policy Revised
August 2018	Annual Review	Policy Revised
August 2017	Annual Review	Policy Renewed
August 2016	Annual Review	Policy Renewed
March 2016	Interim Review	Policy Revised
September 2015	Annual Review	Policy Revised
October 2014	Annual Review	Policy Revised
October 2013	Annual Review	Policy Renewed
December 2012	Annual Review	Policy Renewed
December 2011	Annual Review	Policy Renewed
December 2010	Annual Review	Policy Renewed

New information or technology that would be relevant for Wellmark to consider when this policy is next reviewed may be submitted to:

Wellmark Blue Cross and Blue Shield
Medical Policy Analyst
PO Box 9232
Des Moines, IA 50306-9232

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