Continuous Passive Motion Therapy

Indexing Metadata/Description

- **Procedure:** Continuous Passive Motion Therapy
- **Synonyms:** N/A
- **Area(s) of specialty:** Acute Care, Hand Therapy, Home Health, Orthopedic Rehabilitation, Sports Rehabilitation, Geriatric Rehabilitation
- **Description/use:** Continuous passive motion (CPM) is a method by which a joint (or joints) is moved through a set arc of motion using an external motorized device. CPM is typically used in the first phases of rehabilitation following a surgical procedure as an aid to joint recovery by allowing for better diffusion of nutrients into the damaged and healing areas of the joint

- **Indications**
  - CPM is indicated for:\(^1-14\)
    - Prevention of joint stiffness or tendon fibrosis
    - Increasing or maintaining range of motion (ROM) of a joint, usually following surgery
    - Reduction of postsurgical swelling or hemarthrosis

- **HCPCS codes:** In the United States, CPM is considered unskilled therapy by Medicare and most private third-party payers, and CPM devices are considered durable medical equipment (DME) and fall under the Healthcare Common Procedure Coding System (HCPCS). HCPCS codes include:
  - E0935 continuous passive motion exercise device for use on knee only
  - E0936 continuous passive motion exercise device for use other than knee

(Codes are provided for reader reference, not for billing purposes)

- **Reimbursement**
  - According to the U.S. Centers for Medicare and Medicaid Services, DME is defined as equipment that:\(^2\)
    - Is primarily and customarily used to serve a medical purpose
    - Can withstand repeated use and be used by successive patients
    - Is not generally useful to a person in the absence of injury or illness
    - Is appropriate for use in a patient’s home
  - CPM devices must have the following characteristics to qualify for HCPCS coding:\(^2\)
    - The ability to move the limb in an appropriate plane of motion, in a continuous fashion, at the same rate of speed for a prescribed length of time
    - Adjustable ROM limits
    - Utilize the same arc of motion during each cycle
    - Have easily accessible safety or cutoff switches
    - Be electrically powered. Battery-operated devices must have an adapter
  - Medicare guidelines (U.S.) for coverage of CPM devices
    - Must be used status post total joint replacement of knee or for revisions of tibial or femoral components of knee revisions
    - CPM must be applied within 48 hours after surgery
    - 21-day coverage limit postop
    - If these guidelines are not met, Medicare will not cover the device
• Reimbursement for CPM by third-party payers will depend on insurance contract coverage. Coverage may be available following other surgical procedures or injuries in addition to total knee arthroplasty

**Indications for procedure**
• Pain relief for patients with chronic low back pain (LBP)
• CPM may be used to maintain or improve ROM following:
  • Joint reconstructive surgery or arthroplasty
    – Knee arthroplasty
    – Anterior cruciate ligament (ACL) reconstruction
    – Rotator cuff repair
    – Elbow
• Surgical procedures involving articular cartilage (including microfracture, chondroplasty, autologous chondrocyte transplant, intraarticular fracture, osteochondritis dissecans) that require non-weight-bearing
• Surgery or injury when active physical therapy might not be beneficial or feasible
• CPM may be indicated when a patient is unable to comply with exercise
  • Complex regional pain syndrome (CRPS)
  • Extensive joint contracture

**Guidelines for Use of procedure**
• CPM devices require setting parameters of use
  • Time of use
    – Duration
      - Can vary from 1–4 hours and the type of CPM device used
    – Frequency
    – Total time
• Arc of motion
• Velocity of movement
• Hold time at end of motion
• Inspect skin throughout period of CPM use
• CPM devices require proper fit
  • Minimize migration
  • Support distal and proximal segments properly
  • Maximize comfort
• CPM devices require monitoring for proper usage
  • The actual ROM experienced by the knee may be less than the excursion noted on the device settings
  • Greater knee ROM may be achieved if the patient’s hip is flexed (seated position)
• Protocol should be established for advancement of CPM settings, if appropriate
• CPM devices exist for the knee, ankle, shoulder, elbow, low back, forearm (pronation-supination), wrist, and hand

**Contraindications/Precautions to procedure**
• Contraindications
  • Unstable fracture
  • Uncontrolled/untreated infection
  • Spastic paralysis
  • Deep vein thrombosis (DVT)
  • Poor patient compliance
• Precautions
  • Significant bleeding
  • Sensory impairments
  • Compromised joint soft tissue constraints
  • Skin irritation
May elicit pain of the involved extremity

Possible complications from CPM use\(^{(1)}\)

- Increased postoperative bleeding
- Nerve compression due to local pressure from the CPM unit
  – Signs and symptoms of nerve compression may include: numbness or decreased sensation to the nerve distribution, sharp or burning pain, paresthesia, and muscle weakness\(^{(20)}\)

Examination

**Contraindications/precautions to examination**

- Systemic disease, including rheumatoid arthritis, systemic lupus erythematosus[SLE], metabolic syndrome, sickle cell disease, and myasthenia gravis
- DVT
  – Signs and symptoms of a DVT may include: pain and tenderness in the calf, swelling, and redness
- Infection
- Pediatric patient without presence of and consent of parent/guardian
- Specific guidelines regarding ROM or postoperative precautions should be obtained from referring physician

**History**

- **History of present illness/injury for which the procedure is indicated**
  – Mechanism of injury or etiology of illness: Document mechanism of injury or events leading to current presentation. Document surgical intervention, if any, and postoperative course. Note goals for use of CPM
  – Course of treatment
    - Medical management: Describe current and past medical treatment for the condition
    - Medications for current illness/injury: Determine what medications clinician has prescribed; are they being taken? Note success in relieving symptoms
    - Diagnostic tests completed: Document diagnostic tests (e.g., MRI, X-ray, blood work)
    - Home remedies/alternative therapies: Document any use of home remedies (e.g., ice or heating pack) or alternative therapies (e.g., acupuncture) and whether or not they help
    - Previous therapy: Document whether patient has had occupational or physical therapy for this or other conditions and what specific treatments were helpful or not helpful
  – Aggravating/easing factors: Document factors that increase or decrease symptoms as well as length of time any such factor requires before the symptoms come on or are eased
  – Body chart: Use body chart to document location and nature of symptoms, if applicable
  – Nature of symptoms: Document nature of symptoms (e.g., constant vs. intermittent, sharp, dull, aching, burning, numbness, tingling)
  – Rating of symptoms: Use a visual analog scale (VAS) or 0-10 scale to assess symptoms at their best, at their worst, and at the moment (specifically address if pain is present now and how much). Document increase or decrease of symptoms during use of CPM device. Does position of the joint in the arc of motion impact symptoms (e.g., end ROM)?
  – Pattern of symptoms: Document changes in symptoms throughout the day and night, if any (A.M., mid-day, P.M., night); also document changes in symptoms due to weather or other external variables
  – Sleep disturbance: Document number of wakings/night, if applicable
  – Other symptoms: Document other symptoms patient may be experiencing that could exacerbate the condition and/or symptoms that could be indicative of a need to refer to physician (e.g., dizziness, bowel/bladder/sexual dysfunction, saddle anesthesia)
  – Respiratory status: Document respiratory status (e.g., breathing pattern, breaths per minute, use of supplemental oxygen), if applicable
  – Barriers to learning
    - Are there any barriers to learning? Yes__/No__
    - If Yes, describe __________________________

**Medical history**

- **Past medical history**
  - Previous history of same/similar diagnosis: Document history of trauma or similar dysfunction/injury. Has CPM been used before?
- **Comorbid diagnoses:** Ask patient about other problems, including diabetes, cancer, heart disease, psychiatric disorders, orthopedic disorders, etc.
- **Medications previously prescribed:** Obtain a comprehensive list of medications prescribed and/or being taken (including over-the-counter drugs)
- **Other symptoms:** Ask patient about other symptoms he or she may be experiencing

**Social/occupational history**
- **Patient's goals:** Document what the patient hopes to accomplish with therapy and in general
- **Vocation/avocation and associated repetitive behaviors, if any:** Document participation in sports or other recreational activities. Document current work status. Note current limitations in work, sports, or recreational activities
- **Functional limitations/assistance with ADLS/adaptive equipment:** Document any limitations in ADLS. Document use of equipment or assistive devices (AD) used by patient
- **Living environment:** If applicable, document number of stairs, number of floors in home, with whom patient lives, caregivers, etc. Identify if there are barriers to independence in the home; any modifications necessary?

**Relevant tests and measures:** (While tests and measures are listed in alphabetical order, sequencing should be appropriate to patient medical condition, functional status, and setting)
- For additional information regarding tests and measures for specific procedures, see:
  - Clinical Review... Total Knee Replacement: Physical Therapy; Topic ID Number: T708424
  - Clinical Review... Anterior Cruciate Ligament Reconstruction; Topic ID Number: T708741
  - Clinical Review... Rotator Cuff Injuries; Topic ID Number: T708515
- **Anthropometric characteristics:** Due to swelling, postoperative circumferential measures at the joint, above the joint, and below the joint should be documented
- **Arousal, attention, cognition (including memory, problem solving):** Assess orientation to name, place, time, and situation; attention; short- and long-term memory; and problem solving (all of which can affect the ability to use an AD)
- **Assistive and adaptive devices:** Fit and positioning of the limb in the CPM device should be monitored as per the facility’s protocol for use of the CPM device. Document reports of discomfort and/or pressure of the device against the limb. Assess for need for additional AD
  - If patient is using an AD for ambulation, is the device being used correctly? Is the device appropriate? Is the AD correctly fitted?
  - If patient is using an external support (e.g., knee brace or shoulder sling), does the device fit properly? Is the patient able to remove and/or apply the device properly?
- **Balance:** If postoperative protocol allows weight-bearing, assess balance with Berg Balance Test or Tinetti Test to measure risk of falling
- **Cardiorespiratory function and endurance:** Monitor blood pressure, heart rate, respiratory rate, and oxygen saturation before, during, and after activity, if appropriate
  - 6-minute walk for distance test (6MWT) measures how far a patient can walk in 6 minutes
- **Circulation:** Document presence and integrity of pulse(s). Assess for DVT
- **Ergonomics/body mechanics:** Positioning during use of CPM device should be documented
- **Functional mobility** Note limitations in performance of ADLS
  - A standardized functional assessment such as the FIM may be used
- **Gait/locomotion:** Document gait status, use of ADs, safety, and risk of falling, if appropriate
  - Gait may be assessed with Dynamic Gait Index (DGI)
- **Joint integrity and mobility:** Document joint laxity, if appropriate
- **Muscle strength:** Assess strength of appropriate muscle groups with manual muscle test (MMT), as indicated; keep in mind any restrictions on motions that may be in place
- **Observation/inspection/palpation** (including skin assessment): Document healing status of surgical incision/wound(s). Inspect skin for irritation or indications of pressure resulting from use of CPM device and/or use of bracing
- **Palpation:** Document tenderness of involved joint and related structures
- **Range of motion:** Measure active ROM (AROM) and passive ROM (PROM) using goniometry
- **Reflex testing:** Assess deep tendon reflexes, if appropriate
- **Sensory testing:** Areas of decreased sensation should be noted. Document changes in sensory status
- **Special tests:** Specific validated, functional measurements may be used, depending on the joint/extremity (e.g., Shoulder Pain and Disability Index, Knee Society Score, International Knee Documentation Committee system)
Assessment/Plan of Care

Contraindications/precautions

- Patients with a diagnosis for which this procedure is used are at risk for falls; follow facility protocols for fall prevention and post fall-prevention instructions at bedside, if inpatient. Ensure that patient and family/caregivers are aware of the potential for falls and educated about fall-prevention strategies. Discharge criteria should include independence with fall-prevention strategies
- Observe restrictions or rehabilitation parameters prescribed by physician
- Clinicians should follow the guidelines of their clinic/hospital and what is ordered by the patient’s physician. The summary below is meant to serve as a guide, not to replace orders from a physician or a clinic’s specific protocols
- See Indications for procedure, Guidelines for procedure, and Contraindications/Precautions for procedure

Diagnosis/need for procedure: See Indications for procedure

Prognosis: See Treatment summary, below

- Use of CPM can improve ROM and reduce pain in the short term
- Use of CPM can reduce the need for manipulation under anesthesia (MUA) following knee joint replacement
- There do not appear to be long-term benefits to the use of CPM compared to physical therapy without CPM

Referral to other disciplines: Refer to orthopedic surgeon for lack of progress with therapy

Treatment summary

- Biofeedback relaxation technique can be used as an alternative pain management with CPM for patients undergoing TKA
  - Based on a research study from Taiwan involving 66 patients with post-operative total knee arthroplasty
  - Patients were placed on a standard CPM machine with minimal speed and ROM range of 0 degrees of extension and 35 degrees of flexion, which was increased 5-10 degrees each day depending on the patient’s tolerance
  - A session consisted of 30 minutes of biofeedback while being placed on a CPM. Electrodes were placed over the quadriceps muscle to monitor muscle tension. Heart rate, respiratory rate, and skin temperature were measured and this information was displayed on a monitor
  - Patients were instructed to practice progressive muscle relaxation, which involves tensing all the muscles of the face, inhaling, and counting to 5, then exhaling, relaxing completely, and releasing the tension in the fascial muscles. The procedure continued down the body from the neck, shoulders, chest, abdomen, arms, hands, buttocks, feet, and legs
- Knee arthroplasty
  - There is conflicting evidence regarding the use of CPM as a modality to improve ROM, increase function, and reduce hospital length of stay (HLOS) or the need for MUA during the immediate postoperative period after total knee arthroplasty (TKA). Some of the conflict is a result of differing research methodologies, patient populations, CPM use protocol, and, perhaps, surgical technique
  - Authors of a meta-analysis reviewed 20 randomized controlled trials (RCT) involving 1,335 patients who underwent TKA due to osteoarthritis. Inclusion criteria were that the study was an RCT, all subjects had a preoperative diagnosis of arthritis, and that CPM and standard postoperative care were compared with similar postoperative care
    - High-quality evidence was found that CPM increases passive knee flexion by an average of 2° and active knee flexion by an average of 3°. The difference was not considered clinically significant
    - Active and passive knee extension was not affected by use of CPM
    - HLOS was 0.3 days less with use of CPM
    - Low-quality evidence was found that use of CPM reduced the need for subsequent MUA
  - Authors of an RCT showed that, when compared to sling training, CPM showed no difference in follow-up when comparing PROM scores
  - Based on a study in Germany involving 38 participants who were randomized to either CPM or sling therapy with both groups completing physiotherapy
    - No significant difference was observed at posttest or follow-up
  - Authors of a meta-analysis of 14 studies involving 952 patients examined the effect of CPM on outcome variables of knee AROM and PROM, HLOS, need for MUA, and pain. Inclusion criteria were RCT, controlled clinical trials, case-control studies, or cohort studies published in English or French comparing CPM with placebo, no treatment, or active interventions. All subjects underwent TKA for degenerative joint disease
Statistically significant increases in ROM in the short term were noted in patients who received CPM plus physical therapy versus patients who received physical therapy alone. The increase in ROM was less than 5° and was not considered clinically significant.

- No difference was found in total ROM at 1 year post surgery.
- HLOS was significantly reduced (0.69 days less, 95% confidence interval -1.35 to -0.03) in patients who received CPM plus physical therapy versus physical therapy alone.
- The need for knee manipulation (MUA) was significantly lower in the CPM group (95% confidence interval 0.03 to 0.53).
- No difference was noted in long-term ROM, function (as measured by the Knee Society Score or Health Assessment Questionnaire), or strength.
- Need for HLOS and MUA was reduced.

**ACL reconstruction**

- Authors of a systematic review of 8 published studies including 505 ACL reconstructions examined the efficacy of CPM during postoperative rehabilitation. Inclusion criteria were clinical trials comparing use of CPM versus nonuse of CPM at any point in the rehabilitation period, hamstring or patellar tendon graft, open or arthroscopic technique, and English-language publication.
- No evidence was found to suggest that CPM use plus physical therapy resulted in improved ROM, function (as measured by the International Knee Documentation Committee system), swelling, muscle atrophy, or duration of hospital stay.
- Decreased use of pain medication was reported with use of CPM, but no difference in perceived pain (as measured by a VAS or 4-point scale) was found.

**Rotator cuff repair.** Use of CPM, combined with physical therapy, may improve ROM and decrease pain (as measured by the VAS) in the short term, but has no effect on long-term ROM or function (as measured by a standard shoulder function instrument).

- Based on a randomized, prospective outcome study of 31 patients in the United States.
- Patients were randomly assigned to a CPM group or manual PROM group. Each patient received PROM once a day while in the hospital postoperatively. The CPM group was instructed to use the unit 4 hours per day in 3-4 sessions of 1.5 hours each. The manual PROM group was instructed to perform either self-ROM or have PROM performed by a trained person (family member, relative, friend, home health nurse) 3 times a day. After 4 weeks, both groups began formal physical therapy and CPM was discontinued.
- Actual usage of CPM was 3 hours per day.
- There was no difference in disability, as measured by the Shoulder Pain and Disability Index, between the CPM and PROM groups at the onset of the study.
- The CPM group had significantly less pain, as measured by the VAS, at week one. There was no difference in pain between groups at week 4.
- There was no difference in ROM of external rotation or flexion, isometric strength (as measured by a handheld dynamometer), or the number of outpatient physical therapy visits between groups.
- Manual PROM in the postoperative period was considered to be more cost-effective than use of CPM.
- In an RCT involving 100 patients in Italy, 46 patients were assigned to a group that had PROM performed once a day by a physiotherapist. Fifty-four patients were assigned to a CPM group. The CPM group used the unit for 2 hours per day for 4 weeks postoperatively in addition to PROM. Both groups then underwent the same rehabilitation program.
- Pain, as measured by the VAS, and ROM were assessed at 2.5, 6, and 12 months.
- The CPM group had significantly better (p = .05) flexion, abduction, and external rotation PROM at 2.5 and 6 months. ROM was the same between the groups at 12 months. The CPM group has significantly less pain (p = .05) at 2.5 months. There was no difference in the pain scores between the groups at 6 and 12 months.
- Hand tenolysis--Use of CPM does not appear to improve ROM following digital tenolysis in patients with ROM limitation following previous surgical intervention.

- Based on a retrospective study involving 36 patients in the United States.
- Fifteen patients with 19 involved fingers used a CPM device in addition to AROM and PROM (tendon glides and blocking exercises). CPM was to be used as much as possible. Twenty-one patients with 24 involved fingers were instructed in AROM and PROM only.
- There was no significant difference (p = .29) in the change of total active motion between groups.
• Use of the Kyrobak angular CPM device for low back pain may provide short-term pain relief for patients with non-specific chronic LBP (18)
  – Based on an RCT from Israel involving 28 patients with mild to moderate chronic low back pain
  – Patients were randomized to either the Kyrobak angular CPM or control group
  – Participants in the Kyrobak CPM were asked to place their pelvis on the center of the platform and lie in a supine position and flex the knees to 30 – 45 degrees with feet on the floor. The Kyrobak creates slow angular oscillations of 6 degrees with a variable frequency of 24, 28, or 30 cycles/ minute. Participants were asked to use the CPM device up to 3 times per day for 10 minutes
  – Pain was measured using the numerical rating scale (NRS)
  – Pain reduction was sustained for 3 weeks of daily treatment and was maintained after 3 weeks without further treatment. Further research is warranted to assess the long-term effects on pain management when using the angular CPM device for low back pain
• Patients with adhesive capsulitis and diabetes mellitus may show significant improvements in shoulder function and decreased pain when treated with a CPM device compared to standard physical therapy (19)
  – Based on an RCT from Turkey involving 41 patients with adhesive capsulitis
  – Patients were randomized to either the CPM group (n = 21) or physical therapy group (n = 20)
  – Intervention for the physical therapy group included active stretching, ROM exercises, and pendulum exercises for one hour, 5x/ day for 4 weeks
  – The CPM group used a CPM device with maximal possible adduction/ abduction angles of 0°-30°-175°, internal/ external rotation angles of 90°-0°-90°, flexion/ elevation angles of 0°-30°-175°, and horizontal adduction/ abduction 0°-0°-125°.
  – Both groups also received 20 minutes of hot pack treatment, 5 minutes of ultrasound, and 20 minutes of transcutaneous electrical nerve stimulation (TENS) to the shoulder
  – Pain was reduced at the end of 4 weeks, with both groups showing improvements in the Constant Shoulder Score and having greater AROM/PROM; however, there was significant improvement in the CPM group compared to the physical therapy group

› See Description, Indications of device/equipment, and Guidelines for use of device/equipment, above

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<td>Instructions for CPM use should be given to patient, family, and caregivers</td>
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References


