Anthem

Clinical UM Guideline

Subject: Continuous Passive Motion Devices in the Home Setting
Guideline #: CG-DME-52
Status: New

Publish Date: 01/03/2024
Last Review Date: 11/09/2023

Description

This document addresses the use of continuous passive motion devices in the home setting. Continuous passive motion refers to the use of a motorized device that is applied to an individual's extremity to move the individual's joint continuously and slowly through a predefined arc of motion. Continuous passive motion devices are available for the elbow, hand, knee, shoulder, and wrist joints and are typically used during the immediate postoperative period following joint surgery.

Clinical Indications

Not Medically Necessary:

Use of a continuous passive motion (CPM) device in the home setting is considered**not medically necessary** for all indications.

Coding

The following codes for treatments and procedures applicable to this guideline 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 policy. 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.

When services are Not Medically Necessary:
For the procedure and diagnosis codes listed below:

CPT	
E0935	Continuous passive motion exercise device for use on knee only
E0936	Continuous passive motion exercise device for use other than knee
ICD-10 Diagnosis	
	All diagnoses

Discussion/General Information

Continuous passive motion (CPM) devices move a joint repetitively at a predetermined speed and a preset arc of motion without requiring the individual to exert effort. CPM devices may be applied during the immediate postoperative period following joint surgery to promote the recovery of normal joint range of motion (ROM), to prevent joint stiffness by maintaining normal periarticular soft tissue compliance, and in the case of total knee arthroplasty (TKA), to prevent the development of deep vein thrombosis (DVT) and pulmonary embolism (PE). CPM machines are available for use on various joints including the knee, hip, shoulder, elbow, wrist and ankle. CPM devices do not interfere with open wounds, nursing care or external fixation devices.

CPM devices have been widely used for the treatment and rehabilitation of the upper- and lower-limb joints and for various musculoskeletal conditions, however, there is controversy regarding the clinical effectiveness of this therapy. Although surgical techniques have evolved and CPM following joint surgery has moved primarily from the inpatient to the outpatient (including the home environment), most of the older peer-reviewed literature on CPM evaluated the merits of the device in the inpatient setting.

Lower Extremities

Knee - Anterior Cruciate Ligament Repair

Zhang and colleagues (2022) conducted a systematic review to investigate current elements for postoperative rehabilitation protocol after quadriceps tendon, outline general timelines for progression of those elements, and explore their associated complication rates and profiles. A total of 56 studies were included in the review, of which CPM was described in 8 studies (779 participants), with 4 soft tissue quadriceps tendon (S-QT) studies (219 participants) and 4 bone block quadriceps tendon (B-QT) studies (560 participants). CPM use was initiated immediately postoperatively in all of the studies. The majority of the studies allowed full weightbearing and knee ROM within the first 12 weeks postoperative, and motion-controlled braces within 6 weeks post surgery. Isometric exercises were introduced within 1 week after surgery, closed-chain exercises within 12 weeks, and open-chain and sports-specific exercises within 36 postoperative weeks. Complications such as graft failure (1.2%-1.6%), cyclops syndrome (0.4%-0.7%), and persistent stiffness (0.9%) were similar between graft types. The authors concluded that current postoperative rehabilitation schemes in ACLR with QT offer a complication profile similar to those reported with other graft types. The researchers recommended that rehabilitation protocols focus on early ROM, achieving full extension in addition to isometric quadriceps strengthening. In regards to CPM devices, they suggested that "in specific scenarios such as traumatic ACL rupture and concomitant bony injury, use of CPM may address the increased risks of postoperative stiffness by reducing pain and initiating motion earlier than would otherwise be tolerated".

Andrade and colleagues (2020) conducted a systematic review of clinical practice guidelines for rehabilitation following ACLR. The researchers searched PubMed, Embase, Cochrane, SPORTDiscus, PEDro and grey literature databases for CPGs published up to September 30, 2018. English-language CPGs on rehabilitation following ACL reconstruction that used a systematic search of evidence to formulate recommendations were included in the review. A total of six CPGs with an overall median AGREE II total score of 130/168 points and median overall quality of 63% were included. One CPG had an overall score less than 50% (poor quality score) and two CPGs scored above 80% (higher quality score). The lowest domain score was 'applicability' (can clinicians implement this in practice?) (29%) and the highest 'scope and purpose' (78%) and 'clarity of presentation' (75%). CPGs recommended immediate knee mobilization and strength/neuromuscular training. Based on the review of CPGs for rehabilitation following ACLR, the investigators found that "the benefits of continuous passive motion or postoperative functional bracing are not supported by scientific evidence and clinicians should refrain from adding these interventions to the ACL postoperative rehabilitation".

In another systematic review and meta-analysis (Jaspers, 2019), researchers sought to evaluate the effects of CPM on ROM, swelling and pain after ACL reconstruction. The researchers identified a total of eight studies encompassing 442 participants in the meta-analysis. The beneficial effects of CPM could be identified for the need for pain medication (Hedges' g=0.93; 95% CI = 0.41 to 1.45 during the first 24 hours after surgery), the number of PCA button pushes by the participant during the first 24 hours following surgery (MD=31.20; 95% CI = 11.35 to 51.05), upon regaining knee flexion on the third to the seventh postoperative day (MD=11.6; 95% CI = 1.96 to 21.33) as well as during the third to the sixth postoperative week (Hedges' g=0.93; 95% CI = 0.41 to 1.44) and on swelling of the knee during the fourth to sixth postoperative week (Hedges' g=0.77; 95% CI = 0.35 to 1.18). The results of this meta-analysis suggest CPM may have beneficial effects on pain reduction during the first 2 postoperative days, on knee flexion during the first to the sixth postoperative weeks and on swelling between the fourth and the sixth postoperative weeks. The researchers acknowledged that "the risk-of-bias scores do not allow a high level of evidence".

In 2015, the results of a systematic review of level 1 and level 2 studies conducted by the Multicenter Orthopaedic Outcomes Network (MOON) Group was published. The MOON Group was comprised of orthopedic surgeons who undertook a systematic review the available scientific evidence and collaborated with physical therapy (PT) specialists to determine the best evidence to guide the formation of an ACL reconstruction rehabilitation protocol. With regards to CPM, the researchers evaluated a total of six randomized trials for the rehabilitation of the ACL-reconstructed knee. The evidence did not reveal any long-term benefits or long-term improved ROM as the result of utilizing CPM devices (Wright, 2015).

Knee - Total Knee Arthroplasty (TKA)

Individuals who undergo TKA are particularly susceptible to developing DVT and PE (PE) as a result of tissue damage, surgical stress, immobility and muscle weakness following the surgery. CPM may be offered as a means to passively move an individual's joint through a preset arc of motion, as part of postoperative management. Despite the theoretical effectiveness and widespread use of CPM, there are still diverging views on the effectiveness of CPM as prophylaxis against thrombosis following TKA.

Yang and colleagues (2021) reported the results of a systematic review and meta-analysis of recently published RCTs to evaluate the effectiveness of CPM application on clinical outcomes following TKA. A total of 10 randomized controlled trials (841 participants) were included in the analysis. Data was evaluated for 15 different outcomes, at several time points. Overall, most of the pools demonstrated similar outcome between CPM and noncontinuous passive motion groups. Slight significant differences were identified between the two groups with respect to: the active knee extension at 1 week (mean difference = 3.00, 95% confidence interval = 0.5–5.5, p=0.019), passive knee extension at 1 week (mean difference = 3.00, 95% confidence interval = 0.28–5.72, p=0.031), and 3 months (mean difference = 3.00, 95% confidence interval = 0.5–5.5, p=0.019). The researchers reported that application of CPM was not related to any additional benefit on the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) subscores at all available time points. The time up and go which assessed joint mobility and walking ability was also not improved by the use of CPM at all follow-ups. Knee girth (ie, midpatellar circumference) which is primarily used to reflect the swelling of knee joint, was of similar girths at discharge, 1 week, and 3 months postoperatively. The researchers saw no indication for CPM as a standard of postoperative care in individuals undergoing TKA. The authors acknowledged that some of the limitations of this systematic review and meta-analysis included the relatively small number of studies available for providing primary data and the generally high risk of bias concerning the allocation concealment (selection bias) and blinding of participants (performance bias). However, the authors also pointed out that selection bias and performance bias may be inevitable in the situation of applying the CPM devices to the study participants.

In 2019, Yang and colleagues conducted a systematic review and meta-analysis to evaluate the efficacy of CPM post TKA and whether the use of CPM results in improved clinical and functional outcomes. A total of 16 trials with 1224 participants were included. The pooled results demonstrated that use of CPM did not show a statistically significant improvement of postoperative knee ROM except for middle-term passive knee extension and long-term active knee flexion ROM. Additionally, CPM therapy did not demonstrate a significant positive effect on the functional outcomes. The study results also did not demonstrate a significant reduction in adverse events or length of stay. The researchers concluded that among individuals undergoing TKA, neither the ROM nor the functional outcomes are improved by CPM therapy. Likewise, the risk of adverse advents and length of stay are not reduced by the application of CPM. There is currently insufficient evidence to warrant the routine use of CPM following TKA in clinical practice.

Liao and colleagues (2019) conducted a systematic review and meta-analysis for RCTs that evaluated the clinical efficacy of CPM post knee arthroplasty and determined the predictors of effect sizes of ROM and functional outcomes in individuals with arthritis of the knee. The researchers used the Medline, PubMed, Excerpta Medica dataBASE, Cochrane Library Database, the Physiotherapy Evidence Database (PEDro), and China Academic Journals Full-Text Database and the Google Scholar search engine and did not restrict the search based on language or publication date. The methodological quality (MQ) of the study was assessed using the Physiotherapy Evidence Database (PEDro) scale. A total of 77 RCTs with PEDro scores ranging from 6/10 to 8/10 were included in the analysis. In total, 6038 subjects with mean ages ranging from 52.0 to 74.2 years (overall mean age 65.7 years) were included. Participants experienced symptoms for a mean duration of 110.2 months (range 4–264 months). The 77 RCTs included populations from Americas (709 subjects), Asia (4395 subjects), Europe (692 subjects), and Oceania (144 subjects). The results of the meta-analyses demonstrated there was moderate evidence that CPM exerted short-term (3-month follow-up) benefits on postoperative knee ROM and long-term (12 months) effects on knee function. Researcher reported the preoperative ROM, postoperative day of CPM initiation, daily ROM increment, and total application days were substantial independent predictors of CPM efficacy. The researchers concluded that, based on a moderate level of evidence, "early CPM initiation with rapid progress over a long duration of CPM application predicts higher treatment effect on knee ROM and function".

Gatewood and colleagues (2017) reported the results of a systematic review that investigated the efficacy of device modalities used following arthroscopic knee surgery. A systematic search of the literature was performed using the PubMed; Scopus; MEDLINE; EMBASE; Physiotherapy Evidence Database (PEDro); SportDiscus; and CINAHL databases (1995–2015) for clinical trials using the following device modalities after arthroscopic knee surgery: cryotherapy, CPM, neuromuscular electrical stimulation (NMES), surface electromyographic (sEMG) biofeedback and shockwave therapy (ESWT). Only level 1 and 2 studies were included, and the methodological quality of studies was assessed using PEDro scores. Outcome measured included: muscle strength, ROM, swelling, blood loss, pain relief, narcotic use, knee function evaluation and scores, patient satisfaction and length of hospital stay. A total of 25 studies were included in this systematic review, of which 19 found a significant difference in outcomes. The results of the meta-analysis revealed that CPM does not affect post-operative outcomes. The investigators concluded "CPM is not warranted in post-operative protocols following arthroscopic knee surgery because of its limited effectiveness in returning knee ROM".

Tedesco and colleagues (2017) systematically reviewed and conducted a meta-analysis the evidence of nonpharmacological interventions for postoperative pain management after TKA. Of the 5509 studies considered, a total of 39 randomized clinical trials (2391 subjects) were included in the meta-analysis. The most commonly performed interventions included preoperative exercise, CPM, cryotherapy, electrotherapy, and acupuncture. The meta-analysis revealed very low-certainty evidence that CPM reduces opioid consumption during the early postoperative phase and found low-certainty or very low certainty evidence that CPM provides no improvement in perceived pain.

A 2015 Cochrane review by Chaudry and colleagues evaluated the efficacy of CPM in individuals undergoing primary TKA. A total of

24 randomized trials (pooled n=1445) were included in the review. Researchers utilized the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach to rate confidence in the pooled outcomes. The highest rating assigned was “moderate” confidence for three outcomes: Active knee flexion at 6 weeks (10 studies); function at 6 months (six studies); and quality of life at 6 months (two studies). For each of these outcomes, no significant differences were detected between the CPM and control groups. Although CPM was shown to be advantageous in reducing the proportion of individuals undergoing manipulation under anesthesia at 6 weeks follow-up (the only endpoint for which CPM was found to be effective), this finding received a GRADE confidence rating of “very low” due to imprecision of the pooled effect estimate, the absence of blinding in trials reporting this outcome, and the high degree of heterogeneity among trials. Another conceivable explanation for this finding is changes in practice patterns over time. None of the trials published after the year 2000 favored CPM as an effective means to reduce the likelihood an individual will undergo manipulation under anesthesia, so it is possible that more recent rehabilitation protocols or changing surgeon preferences pertaining to manipulation under anesthesia could have nullified the effects demonstrated in earlier trials. After reviewing the currently available literature and analyzing the data, the authors concluded that “there is at this stage no indication for continuous passive motion procedures in individuals operated with TKA as a standard postoperative care” (Chaundry, 2015).

In another Cochrane review, Harvey and colleagues (2014) assessed the benefits and harms of CPM and standard postoperative care versus similar postoperative care, with or without additional knee exercises, in individuals with knee arthroplasty. Researchers searched various databases including the Cochrane Central Register of Controlled Trials (CENTRAL) (The Cochrane Library 2012, Issue 12), MEDLINE (January 1966 to 24 January 2013), EMBASE (January 1980 to 24 January 2013), CINAHL (January 1982 to 24 January 2013), AMED (January 1985 to 24 January 2013) and PEDro (to 24 January 2013). A total of 24 RCTs including 1445 participants met the inclusion criteria; four of these trials were new to this update. The authors concluded that CPM does not have clinically important impact on active knee flexion ROM, pain, function or quality of life to justify its routine use. While CPM may lower the risk of manipulation under anesthesia and risk of developing adverse events, the quality of evidence supporting these findings are very low and low, respectively. The effects of CPM on other outcomes are not clear.

He and colleagues (2014) reported the results of a Cochrane review designed to determine the effectiveness of CPM therapy for preventing venous thromboembolism (VTE) in individuals following TKA. The study included RCTs comparing the use of CPM with control in preventing DVT or PE following TKA. Participants 18 years of age and older who had undergone TKA were included in this review. Participants who presented with DVT at baseline were excluded from the study. Except for CPM, the experimental and control groups received similar postoperative care and therapy. A total of 11 trials involving 808 participants in were included in the review. The methodological quality of the included studies varied, and the quality of the evidence was low because the outcomes of interest were only reported in one or two studies. Sensitive tests such as venography or sonography were not always used to diagnose DVT and CPM was applied inconsistently across studies, varying in ROM, duration of CPM per day and the number of days following the surgery. The was not a clear difference in the incidence of DVT or VTE in the CPM group compared with the control group of participants. This review failed to find enough evidence from the RCTs reviewed to conclude that CPM reduces VTE (He, 2014).

Despite the widespread use of CPM following TKA, few specialty associations or professional medical societies have issued recommendations regarding the use of CPM. In its guidelines on the Comparative Effectiveness Review of Prehabilitation and Rehabilitation for Major Joint Replacement, the Agency for Healthcare Research and Quality (AHRQ) purposely excluded studies with a primary intervention of CPM, due to strong evidence that it is ineffective (Konnyu, 2021). The 2020 American Physical Therapy Association’s guidelines on the management of TKA indicate that physical therapists should NOT use CPMs for individuals who have undergone primary, uncomplicated TKA (assigned a high quality, moderate strength rating). The authors also caution that “there is a preponderance of evidence to support that there is increased risk, harm, and/or cost related to use of CPM for uncomplicated TKA” (Jette, 2020).

Ankle

Barbosa (2021) reported the results of a systematic review of RCTs of physiotherapy interventions for the treatment of spasticity in people with spinal cord injury. The reviewers identified one trial which used CPM as a treatment for muscle spasticity. The trial compared CPM of the ankle to no treatment. The degree of spasticity was measured using the Modified Ashworth Scale and demonstrated a mean (95% CI) between-group difference of –3.1 points (–3.9 to –2.4) signifying a decrease in spasticity in the CPM group compared to the no treatment group. Barbosa and colleagues point out that while this trial demonstrated a treatment effect, it is worth noting that this trial assessed CPM for the ankle with a no treatment comparator. The authors also commented that the results of this systematic review revealed how little is known about the effectiveness of different physiotherapy interventions for the management of spasticity.

Foot

A 2020 Cochrane review evaluated interventions for idiopathic congenital talipes equinovarus (CTEV, also referred to as clubfoot) (Bina 2020). Of the 21 studies (905 participants) that met the inclusion criteria, the researchers were able to identify only one study (Zeifang, 2005) which included CPM as an intervention for congenital talipes equinovarus. Zeifang and colleagues investigated CPM versus cast immobilization post CTEV in 36 children (36 feet) who had failed at least 6 months of manipulation and casting. At 48 weeks post treatment, the Dimeglio club foot score was used as the primary outcome measure. The average age of the participants was 8.2 months and all had been classified as having severe CTEV based on the Diméglio scale. In both groups a casting was applied post-operatively for the first 10 days. Kirschner wires were removed from the feet of all participants 2 weeks post-operatively. Participants in the casting group underwent casting for another 4 ½ weeks. Participants in the CPM group received CPM therapy for 4 hours per day. During rest periods, the CPM machine was removed and splints applied. At 6 weeks post operatively, all feet were treated with a brace at night. Both groups underwent physiotherapy for another 6 months. When the subjects began to walk, they were provided with heel cups and place in conventional shoes. Participants were followed up at 48 months postoperatively. Study results demonstrated that ROM in the feet treated by CPM significantly increased at 6 and 12 months following surgery compared with those treated by casting (p=0.013 and p=0.009, respectively). However, no significant difference was observed after 18 and 48 months. Some of the limitations of this study include its small size and the high risk of bias due to the lack of allocation concealment and the lack of blinding. Zeigang and collegues acknowledged that because no additional long-term benefit was demonstrated with the use of CPM and because the number of feet requiring additional surgery was comparable in both groups, “it is difficult to recommend the use of CPM treatment which is also much more expensive”. The Cochrane researchers concluded that there is a lack of evidence for CPM following major foot surgery.

Upper Extremities

Shoulder

Jain and colleagues (2014) conducted a systematic review to evaluate the evidence for PT interventions as a treatment of frozen shoulder (adhesive capsulitis). A total of 39 studies were identified. following the exclusion of one retrospective study that included 2370 participants, the total number of subjects averaged 49.5 with 31.4 (63.4%) subjects being females per study. Most studies included a control group, while five of the cohort studies had no control group and six studies were either case report or case series.

In the reviewed studies, follow-up time post-intervention ranged from day 1 to 9.2 ± 9.7 years. While a variety of interventions including but not limited to joint mobilization of the should girdle, mobilization with movement, acupuncture, and ultrasound were considered in the systematic review, only one study (Dundar, 2009) explored the use of CPM as a therapeutic intervention for frozen shoulder. Dundar and colleagues found that CPM was more effective at reducing pain than active stretching exercises at short term follow-up. Based on the available level of evidence, Jain and colleagues recommended CPM for short-term pain relief but not for improving ROM or function.

In 2016, Thomson and colleagues reported the results of a systematic review conducted to provide guidance on the most effective post rotator cuff (RC) surgery rehabilitation protocol. Postoperative rehabilitation interventions considered included exercise therapy, CPM and aquatic therapy. A total of five studies were identified that specifically explored the use of CPM following RC repair (Du Plessis, 2011; Garofalo , 2010; Lastayo. 1998; Michael, 2005; Raab, 1996). Of these five studies, three (Garofalo , 2010, Lastayo. 1998, Raab, 1996) investigated the use of CPM machine vs range of movement exercises. The study by Lastayo was the only study included in the review that explored the use of CPM following open RC repair (acromioplasty). After systematically reviewing the literature, the researchers concluded that:

> There was no benefit found in favour of any one rehabilitation method when comparing data from the included studies … High quality RCTs are required with larger study populations, longer term follow up, standardised treatment protocols and outcome measurements so that more accurate results may be obtained and data may be pooled with confidence and generalised to other populations (Thomson, 2016).

Wrist

In a Cochrane review, Peters and colleagues (2021) assessed the benefits and harms of different rehabilitation interventions after surgery for flexor tendon injuries of the hand. In this systematic review, the researchers were able to identify one study (Gelberman 1991) that explored the use of CPM as an intervention following flexor tendon repair. The quasi-randomized trial of 51 subjects (60 digits) with zone II flexor tendon repairs, compared the use of a CPM device (CPM control group) with controlled passive exercise regimen using rubber band traction (controlled passive group). Participants started therapy on the first postoperative day. Digits were protected in dorsal-blocking orthosis for at least six weeks. The CPM group had the device attached to the protective orthosis on the first post operative day to allow 60 degrees arc of proximal interphalangeal (PIP) joint and a 30 to 40 degree arc of distal interphalangeal (DIP) joint motion. The CPM group used the device in isolation for 8 to 12 hours a day during the first 4 weeks. Active movements were incorporated at 4 weeks to be performed in conjunction with the motion provided by the CPM device. The controlled passive group was placed in a similar dorsal blocking orthosis but traction was applied with a rubber band. Participants performed active extension and passive flexion to the palmar crease for the first 4 weeks, when active flexion was introduced. Gelberman and colleagues noted frequent problems with mechanical breakages and power failures with the CPM devices early on as well as issues with adherence. However, these were improved with increased time spent on education, both initially and at intervals throughout the rehabilitation phase. Outcomes were evaluated by treating therapists at a minimum of 6 months post surgery (mean 10.8 months, range: 6 to 38 months). Outcomes included active finger ROM using the TAM and Strickland-Glogovac classification score and adverse events (tendon rupture and infection). The Cochrane reviewers determined that “there is very low-certainty evidence of marginally higher total active ROM values in the CPM group at six months.” Researchers reported one tendon rupture and no infections.

In another Cochrane review, Handoll and colleagues, (2015) examined the effects of rehabilitation interventions in adults with conservatively or surgically treated distal radial fractures. A total of 26 trials, involving 1269 participants, (primarily older female subjects) were included. With a few exceptions, these studies did not include individuals with serious fracture or treatment-related complications, or older individuals with comorbid conditions and poor overall function that would have precluded trial participation or required more intensive treatment. Only four of the 23 comparisons included in these 26 trials were evaluated by more than one trial. Of the 26 trials evaluated in this systematic review, only one trial (Rozencwaig, 1996) included CPM as a rehabilitation intervention following external fixation of distal radial fractures. This quasi-randomized trial included a total of seven participants who, following surgery were treated with occupational therapy alone or occupational therapy plus CPM at home for 4 to 6 hours/day for 1 month. The 3 participants in the intervention group required less time (mean 12 days) to achieve a completely independent status compared to the 4 control group participants. Rozencwaig also reported that reported that recovery of ROM of the affected wrist occurred more quickly in participants receiving CPM. In addition to the study only being available in abstract form, the authors of the Cochrane review identified several limitations to the Rozencwaig study, including but not limited to its small sample size and short follow-up. Because blinding participants and treatment providers was impractical, the study was at high risk of detection bias. The Cochrane review concluded that the Rozencwaig study “provided very low quality evidence” on CPM applied post-external fixation.

Other Conditions

Heterotopic Ossification

Vasileiadis and colleagues (2023) conducted a systematic review to investigate the existing evidence in the literature on the role of active and passive kinesiotherapy (including CPM) in the evolution of heterotopic ossification (HO) and, possibly, to recommend special kinesiotherapy based on type of HO. A search of the literature identified 5 studies for inclusion in the review. Two of the studies were of retrospective design, one was a multicenter cross-sectional survey, and 2 were case reports. A total of 796 participants experienced traumatic brain injury, spinal cord injury, or stroke, of which 122 developed HO. All participants followed rehabilitation programs that included passive ROM (PROM), CPM, or PT, either alone or in some combination. The authors found that:

Studies of neurogenic HO individuals using CPM within the pain-free ROM have shown protective role of CPM in preserving the ROM of HO joints, whereas studies of posttraumatic HO and burn-associated HO indicated that active ROM in painless limit is beneficial for HO prevention.

However, the authors did acknowledge that “because of the very low quality of the studies included in this review, firm conclusions cannot be drawn about the effectiveness of kinesiotherapy” (Vasileiadis, 2023).

Intensive Care Unit-Acquired Weakness

Intensive care unit-acquired weakness (ICU-AW), a common neuromuscular complication associated with individuals with critical illness in the ICU, is a type of skeletal muscle dysfunction that frequently occurs following mobility restriction, sepsis, hyperglycemia, and the use of glucocorticoids or neuromuscular blocking agents. ICU-AW can lead to delayed withdrawal of mechanical ventilation and extended hospitalization. Early mobilization, including active and passive motion in bed along with mobilization out of bed, is recommended to prevent the development of ICU-AW (Vollenweider, 2022; Wang, 2020).

In a systematic review, Vollenweider and colleagues (2022) evaluated RCTs in English or German languages to summarize the effects of passive motion on the lower extremities of sedated and ventilated individuals in the ICU. Outcomes of interest included the effect passive motion on musculature, inflammation, the immune system and the development of ICU-AW. Additionally, the

researchers aimed to evaluate the replicability of the used interventions and the methodology of the included studies for practical settings. A total of 5 studies were included in the qualitative syntheses. Studies were assessed based on their description (TIDieR checklist) and their methodological quality (Downs and Black checklist). On average, the studies were rated with 6.8 out of 12 points abased to the TIDieR checklist and scored an average of 19.8 out of 27 points on the Downs and Black checklist. The study results indicated that muscle loss may be reduced by passive manual movement, passive cycling and passive motion on a CPM unit. Additionally, positive effects were reported on the reduction of nitrosative stress and the immune response. The researchers concluded that passive movement demonstrated a slight tendency for beneficial changes on cellular level in sedated and ventilated individuals in the ICU within the first days of admission, which may indicate a reduction of muscle wasting and could prevent the development of ICU-AW.

The results of one study (Griffiths, 1995) explored whether muscle wasting in critically ill individuals can be prevented by passive stretching alone in the absence of contractile activity. A total of 5 critically ill subjects who required a complete neuromuscular blockade for 7 days of ventilator support were studied. One leg of each participant was treated with CPM for three 3-hour periods daily while the other leg received only routine nursing care. The researchers found that CPM significantly reduced muscle fiber atrophy and protein loss, when it is compared to standard therapy. The researchers also stated that future RCTs should record both the acute and the long-term effects of the interventions and that studies with larger populations, longer intervention periods or higher dosages, rigorous methodological quality as well as the start of early mobilization within 48 to 72 hours in the ICU are needed.

Summary

Although CPM devices have been widely used for the treatment and rehabilitation of the upper- and lower-limb joints and for various musculoskeletal conditions, there is controversy regarding the clinical effectiveness of this therapy. Older studies most frequently evaluated the use of CPM devices in the inpatient setting and are less reflective to today's practice patterns which tend to consist of short hospital stays followed by rehabilitation in the outpatient (including home) setting. 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.

There is a lack of conclusive evidence in the peer-reviewed literature confirming that the home CPM therapy alone or in addition to standard PT regimens results in meaningful improvements in the clinical outcomes following joint surgery. Historically, CPM was used following joint surgery with the assumed benefits of improving function and rehabilitation. However, the results of numerous systematic reviews and/or meta-analyses have failed to demonstrate that CPM alone or in combination with standard PT reduces postoperative pain, swelling or improves ROM, functionality or quality of life. Additionally, despite the theoretical effectiveness of including CPM as part of the postsurgical management of individuals undergoing TKA, there is a lack of evidence demonstrating that prophylaxis CPM prevents thrombosis following TKA. It is also worth noting that while there is some data to suggest that in some cases CPM is as effective as PT, CPM therapy may be more costly than standard PT therapy (Zeigang, 2005).

There is also a lack of guidance from specialty associations/societies regarding the role of CPM in rehabilitation therapy. No professional society guidelines or position statements were identified that provided recommendations on selecting the appropriate candidates for home CPM therapy, determining when treatment should be initiated or the frequency and duration of treatment. At the time of this review, only one professional society guideline was identified that addressed the use of CPM devices. The American Physical Therapy Association assigned a high quality, moderate strength rating to their recommendation that "physical therapists should NOT use CPMs for patients who have undergone primary, uncomplicated TKA" (Jette, 2020). While in the past the use of CPM was commonly incorporated into the postoperative treatment plans of patients undergoing joint surgery, the routine use of CPM following arthroplasty is no longer considered in accordance with generally accepted standards of practice.

Definitions

Heterotopic ossification: The abnormal formation of pathological bone outside of skeletal tissues (for example in tendons or muscle. Heterotopic ossification may be caused by burns, surgery or trauma (including but not limited to bone fractures).

Knee arthroplasty (also referred to as knee replacement or total knee replacement, is a surgical procedure to resurface a knee using metal and plastic parts to cap the ends of the bones that form the knee joint (the femur [thigh bone], tibia [shin bone], and patella [kneecap]).

Nitrosative stress: A pathological condition that contributes to the deterioration of systems and organs.

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The use of specific product names is illustrative only. It is not intended to be a recommendation of one product over another, and is not intended to represent a complete listing of all products available.

History

Status	Date	Action
New	11/09/2023	Medical Policy & Technology Assessment Committee (MPTAC) review. Initial document development.