CPM: Healing in Motion

Many orthopedic surgeons consider the use of continuous passive motion beneficial in expediting postoperative rehabilitation.

by Ruth Stroud

Continuous passive motion devices, in use for more than two decades, have experienced varying degrees of popularity and controversy through the years. Robert B. Salter, MD, a Toronto orthopedic surgeon, first pioneered the biological concept of continuous passive motion (CPM) more than 30 years ago, as a means of healing and regenerating joint cartilage.

As described by Shawn W. O'Driscoll, MD, PhD, and Nicholas J. Giori, MD, PhD, the basic premise that Salter put forth after studying the effects of immobilization on the articular cartilage of rabbit knee joints is that "because immobilization is obviously unhealthy for joints, and if intermittent movement is healthier for both normal and injured joints, then perhaps continuous motion would be even better." However, because patients could not be expected to move their own injured joints continuously for hours at a time, the movement would of necessity be passive.[1]

According to Rick Hammesfahr, MD, and Mark T. Serafino, MS, PT, CPM "is one of the primary methods for decreasing the deleterious effects of immobilization and can deliver orthopedic, neurological, and even circulatory benefits to the patient. Immobilization, in turn, can create deleterious sequelae of physiological and functional impairments."[2]

Postsurgical Use

Through the years, CPM devices have been created for most of the major joints of the upper and lower extremities, but they appear to be most frequently prescribed for use in postsurgical injuries of the knee or shoulder. They are generally provided through devices that are mechanically designed to bend and flex joints at a given rate over a period of several hours.

In recent interviews with several orthopedic surgeons and physical therapists, the uses, benefits, and potential drawbacks of CPM therapy were discussed. Although not intended as a scientific cross-section of opinion on the subject, the comments offer a sampling of views on the use of CPM therapy in conjunction with traditional "hands-on" physical therapy.

Practical Uses of CPM

Michael Krinsky, MD, an orthopedic surgeon in private practice in Castro Valley, Calif, uses CPM primarily for knee replacement surgeries, whether total or unicompartmental, and for anterior crucial ligament (ACL) reconstruction. For knee replacement surgery, Krinsky puts the patient in the CPM apparatus in the recovery room.

"I find that use of CPM immediately helps to prevent development of hemarthrosis, or accumulation of blood in the joints," he says. "By moving the knee for the first 24 hours [following surgery] continuously, it pumps most of the blood out through the drain, and the patient doesn't accumulate a lot of blood in the joint."

The procedure has proved beneficial for the patient in terms of pain management and by, in most cases, eliminating the need to aspirate the joint postoperatively.

Krinsky sets the machine to go from full extension (0 degrees) to 90 degrees flexion in the recovery room. The first day following surgery, he puts the patient in the machine for a couple of hours three times a day, increasing the degree of flexion by 5 degrees to 10 degrees daily. After the machine reaches about 115 degrees, the patient goes home or to a rehabilitation facility, taking the machine with them, Krinsky says. He says he has the patient use the machine for about 2 weeks postoperative. "By that time, they're usually in an outpatient physical therapy setting and don't need the machine anymore."

Krinsky acknowledges that CPM has been beneficial for the patients for whom he has prescribed it. "My percentage of manipulations postoperatively [in knee replacement surgery] is very low, and I attribute a lot of that to the fact that I use the CPM from the beginning for a 2-week period."

Occasionally, the surgeon has a reluctant patient tell him that they cannot tolerate the CPM. "I tell them they can tolerate it a lot better than they can tolerate a manipulation under anesthesia," Krinsky says.

For ACL reconstructions, the surgeon braces the patient's knee in full extension for the first 24 hours, then puts him in the CPM machine when he returns home. The patient uses the CPM machine two or three times a day for a couple of hours, increasing the flexion angle about five degrees each time he uses it. Since there is less trauma to the surrounding tissues with ACL reconstructions compared to knee replacement surgeries, Krinsky says patients can tolerate a faster increase in motion.

He also uses the machines for shoulders for adhesive capsulitis. This is a scarring of the joint capsule that leads to limited shoulder mobility, sometimes referred to as "frozen shoulder." Krinsky sometimes treats the condition by doing a manipulation under anesthesia, followed by an arthroscopic release and debridement. He then puts the patient on CPM post-operatively for 1 to 2 weeks.

"My feeling is if you don't get them moving right away and keep them moving, then they're just going to go back to the way they were pre-operatively."

Although far rarer, Krinsky has also used CPM following cheilectomy surgery on the big toe to remove bone spurs in the toe's metatarsophalangeal joint. The machine helps the toe regain mobility through a flex and extend motion similar to that of the knee.

Stimulating Cartilage Cell Growth

Kevin Stone, MD, founder of The Stone Clinic in San Francisco and founder and chairman of the Stone Foundation for Sports Medicine and Arthritis Research, is an orthopedic surgeon specializing in sports injuries, particularly those of the knee and shoulder. An internationally recognized authority on cartilage growth, replacement, and repair, Stone says he uses CPM for articular cartilage case-grafting techniques, a procedure in which articular cartilage is regenerated inside people's knees in a single outpatient arthroscopic procedure. Postoperatively, CPM is used for 4 weeks for 6 hours a day in order to help stimulate growth in the articular cartilage cells, Stone says.

"We've been doing that since 1989 and have found that the patients who use CPM appear to get a better repaired surface than those who don't," he says.

Stone also recommends CPM before and after an ACL reconstruction to help diminish swelling in patients' knees. "We find it's useful for getting the swelling down or to help the patient prepare for surgery after an acute injury," he says. The clinic also uses CPM following fracture repairs around the knee and ankle in order to diminish scar tissue and promote better healing, and to improve range of motion in frozen shoulders or stiff knees and ankles.

There are certain operations for which Stone does not recommend CPM. Among these are meniscal repair or meniscal transplantation. "In that situation, we prefer to err on the side of meniscus healing rather than motion in the knee," he explains. For example, he also does not recommend CPM for patients after joint replacement. "We find that our patients regain their range of motion very quickly with or without CPM after any kind of joint replacement," he says.

Keep It Moving

Maureen Madden, PT, CSCF, a physical therapist at The Stone Clinic, called CPM a valuable but "minuscule" part of postoperative therapy for treatment of a number of injuries and conditions. The major reason for employing it is to prevent adhesion formation of the soft tissues that can result in stiffness and loss of motion.

"We want that shoulder or knee to keep lubricated and not to get locked down," says Madden. "There's such a positive benefit to movement for all kinds of reasons—for pain, swelling, and range of motion."

The length of the CPM process—often 6 hours or more—is important, she adds. "If you think about it, those of us who aren't hurt probably move through our joints at least 6 hours a day," she says.

Many patients object to the therapy, find it a "pain in the neck" to be strapped into a device for 6 hours, and have difficulty sleeping while in it, she said. Others, however, really take to the CPM machines. "They feel like it's a relief because they get in there and it helps with their pain," Madden says.

Whether they like the devices or not, most patients recognize the ultimate benefits of CPM and realize they will have to tolerate it for only a limited period of time.

CPM: Costs, Benefits, and Controversy

Hammesfahr, an orthopedic surgeon at the Center for Orthopaedics & Sports Medicine in Marietta, Ga, cited a study by Worland et al[2,3] that found that costs for a group of patients who underwent a total knee arthroplasty and received only CPM upon discharge from the hospital, instead of professional physical therapy, were about half as much as for a physical therapy group, and there was no statistical difference in the range of motion achieved between the two modalities. Few surgeons recommend a strict postoperative regimen of CPM, but Hammesfahr believes there are some definite cost-saving benefits of using the devices when appropriate.

"Typically, patients who are on CPM devices require less pain medication than those who aren't. The overall cost of recovery from the injury changes," he says. "There's an up-front cost of the CPM device that is more than offset by the decreased time in rehabilitation, because patients [regain] their motion much, much earlier."

He offers an example of a patient who undergoes an ACL reconstruction and uses the CPM device. The return to normal motion is about 10 to 14 days, he estimates, compared to the patient who goes through traditional physical therapy and does not use the CPM apparatus. For the latter, the recovery is about 4 to 6 weeks.

"In either case, the patient may require 6 weeks of physical therapy, but in the first case the patient has much better motion and much greater strength and has been more ambulatory and more mobile than in the second case," Hammesfahr says. "Without motion, you can't get strength back. The recovery time becomes much longer, because not only is someone trying to recover from a position of sickness, but also a position of weakness," he says.

Hammesfahr routinely recommends CPM devices for total knee replacements of the knee and shoulder, tibial plateau fractures, different kinds of patella fractures, ligament reconstructions, and rotator cuff surgery and repairs.

"Basically, we tend to use CPM in operations around the joints where there has been significant trauma to the joint and the risk of stiffness is high," he says.

There have been fewer controversies in recent years regarding the use of CPM, as insurers have become more accepting of the value of using the devices, Hammesfahr says.

Hammesfahr recalls that in the late 1990s up until about 2001 he would routinely write letters of appeal to insurers regarding the usefulness and cost-saving benefits of CPM machines. "That has really tapered off. We rarely have to appeal a decision where they wouldn't authorize it," he says. "The insurance companies have pretty much come around on that point." OTR

EDITOR'S NOTE: References for this article can be found on the Web at *www.orthopedictechreview.com.*

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