

Continuous Passive Motion: From Origination to Research to Clinical Applications



I am grateful to Dr. Duncan Gordon for requesting this editorial to accompany the metaanalysis by Brosseau, *et al* in this issue of *The Journal*¹. For the sake of historical accuracy the authors could have included in their introduction reference to my original 1975 abstract², as well as 2 subsequent full articles^{3,4} and my 419 page monograph on continuous passive motion (CPM)⁵.

In 1970, I originated the (then new) biological concept of CPM of joints after making 23 experimental and clinical observations including the deleterious effects of immobilization of joints. Thus, CPM is a concept, not just “a motorized device.”

After 8 years of basic research in rabbits, having convinced myself that CPM was both safe and effective, I felt justified in applying the concept in the postoperative care of adult humans with a wide variety of disorders and injuries of joints. My basic research continues (1970 to 2004) and on the basis of the results of 27 separate research projects, I have recommended a total of 13 indications (of which one is total knee arthroplasty). From the outset I have recommended that, for a given patient, CPM should be under the combined supervision of the treating physiotherapist and orthopedic surgeon.

I realized that one cannot regenerate cartilage on a prosthetic joint surface, but I hypothesized that CPM applied immediately after total knee arthroplasty would reduce postoperative pain, improve local circulation (both arterial and venous), reduce swelling, accelerate return of joint motion, and reduce the incidence of the serious complication of intraarticular and extraarticular adhesions (that necessitate manipulation of the joint under general anesthesia).

Since total knee arthroplasty is an operation that is limited to adults, I, as a pediatric orthopedic surgeon, do not perform this operation but many of my colleagues worldwide have informed me that my hypotheses are correct.

Using my protocol that includes a duration of CPM for

23 hours a day and from one to 4 weeks, Coutts in 1982⁶ and again in 1984⁷ reported that in patients treated by CPM after knee arthroplasty there was a highly significant increase in the range of knee joint motion (that was still apparent after one year), a dramatic decrease in the need for pain medication, and virtual absence of edema and effusions. Further, no CPM-treated patient required a manipulation of the knee joint for stiffness (compared to 21% in the control group).

Subsequently, some physiotherapists or orthopedic surgeons have shortened the duration of CPM per day and the number of days of duration, with less dramatic results.

In the 14 trials reported by Brosseau, *et al* the hours of CPM per day varied from 5 to 18 and the number of days of CPM varied from one day to 2 weeks. As stated in their abstract, from the review of 14 studies (952 patients) they found that with CPM there were “significant improvements in active knee flexion, and analgesics use 2 weeks post operatively. In addition, length of hospital stay and the need for knee manipulations were significantly reduced.”¹

Further, the authors state in the abstract, “In conclusion, CPM combined with physiotherapy *may* offer beneficial results for patients post-knee arthroplasty.” Even the results of their metaanalysis study justify changing the word “may” in this sentence to “do.”

In the penultimate paragraph of the article the authors make the statement that “These potential benefits will need to be carefully weighed against the inconvenience and expense of CPM.” In the experience of my colleagues who send their total knee arthroplasty patients home in a few days with a rented CPM device to be used in their homes, this arrangement is much more convenient for the patient than making frequent trips to the physiotherapy unit, either in their hospital where the surgery was performed or to a unit in another facility.

Concerning “the expense of CPM,” Stephen Soong, a

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former staff member of OrthoMotion Company, which manufactures CPM devices, has estimated that the use of CPM saves from \$2000 to \$4000 per patient over a 6-month period.

It has been estimated by the president of an American company that makes and sells CPM devices that, as of 2002, CPM was being used in 17,000 hospitals in 77 countries and that about 7 million patients had been treated using CPM.

This obviously means good acceptance of a biological concept that after 1970 was the precise antithesis of the previously accepted nonscientific dogma of forced immobilization of joints.

I congratulate Dr. Brosseau and her coauthors on an exhaustive metaanalysis of the efficacy of CPM following total knee arthroplasty. I would encourage them, as they have suggested, to conduct further studies to assess the effectiveness of CPM by altering treatment variables, including the total duration and intensity of CPM interventions and defining the most efficacious CPM treatment regimen.

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