

Knee CPM Objectives and Indications

ARTICULAR CARTILAGE

Numerous studies initially performed on animals by Dr. Robert Salter have been validated in human subjects. Knee CPM is appropriate following microfracture, OATS, and mosaicplasty procedures. CPM helps improve fluid dynamics in the joint and in the healing of articular cartilage and periarticular tissues. Studies by O'Driscoll and others have demonstrated the stimulating effect CPM on periosteal neochondrogenesis and generation of tissue that resembles hyaline cartilage upon histological analysis.

ACL

The stimulating effects of CPM generated by cyclic tensile stress on the affected tissue help to reduce inflammation, pain, swelling, and stiffness following ACL reconstruction. Studies demonstrate reduced pain medication intake and accelerated recovery of range of motion.

The Extend Assist™ Knee CPM Kit can also help patients attain terminal knee extension earlier. This can be an important factor in accelerating the rehab process.

TOTAL KNEE ARTHROPLASTY

Numerous studies have analyzed the effects of CPM following total knee arthroplasty. Some studies claim that CPM is not effective for this application, concluding that long-term range of motion is similar in CPM and non-CPM groups. What many of these studies often fail to acknowledge are the numerous short-term benefits of CPM use that can reduce pain and swelling, accelerate rehabilitation, improve compliance, and lead to fewer complications and the potential for additional surgical intervention with procedures such as manipulations and debridements of stiff joints. Many studies have shown statistically significant improvement in both short and long-term outcomes with knee replacement patient populations.

Knee CPM Supporting Documentation

ARTICULAR CARTILAGE

BASIC SCIENCE:

Title: The Physiologic Basis of Continuous Passive Motion for Articular Cartilage and Healing

Source: *Hand Clin* 10(2): 211-9, 1994

Author: Salter RB



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Overview: Salter (1994) in this article presents an overview of the first 23 years of basic research and 15 years of clinical application of CPM, especially in comparison to immobilization and intermittent active motion. The author concludes, CPM is well tolerated (relatively painless) by both adolescent and adult rabbits; has a significant stimulating effect on the healing of articular tissues (cartilage, tendon, ligament); prevents adhesions and joint stiffness; enhances wound healing; regenerates articular cartilage through neochondrogenesis both with and without periosteal grafts.⁴

CHONDRAL DEFECTS:

Title: **Improvement of Full-Thickness Chondral Defect Healing in the Human Knee After Debridement and Microfracture and Using Continuous Passive Motion**

Source: *Am J Knee Surg* 7(3), Summer 1994

Authors: Rodrigo J, Steadman R, Sillman J, and Fulstone H

Overview: Rodrigo et al. (1994) compared postoperative care utilizing CPM for full-thickness chondral defect healing for 8 weeks, 6-8 hours a day (46 patients) with a non-CPM group (31 patients). The mean improvement was statistically superior in the CPM group over the non-CPM group. Only 15% of the CPM group had no improvement in grade, while 45% of the non-CPM group exhibited no improvement. The results substantiate Salter's conclusions from animal experimental investigations that CPM resulted in better healing than intermittent active motion.³

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REDUCTION IN PAIN MEDICATION REQUIRED:

Title: **The Effects of Immediate Continuous Passive Motion on Pain During the Inflammatory Phase of Soft Tissue Healing Following Anterior Cruciate Ligament Reconstruction**

Source: *J Orthop Sport Phys Ther* 17 (2): 96-101, Feb 1993

Authors: McCarthy MR, Yates CK, Anderson MA, Yates-McCarthy J

Overview: In a study done by McCarthy et al. (1993), results indicated that the initiation of CPM immediately following ACL reconstruction had a significant effect on decreasing the amount of medication consumed by the patient, and a significant decrease in the patient's need for medication during the inflammatory phase.⁴

REDUCED PAIN/SWELLING/PAIN MEDICATION; IMPROVED KNEE EXTENSION:

Title: **Effects of Continuous Passive Motion Following ACL Reconstruction with Autogenous Patellar Tendon Grafts**

Source: *Journal of Sports Rehabilitation* 1: 121-131, 1992.

Authors: Yates CK, McCarthy MR, Hirsch HS, Pascale MS

Overview: Yates, et al. (1992) performed a study examining the benefits and possible risks of imme-



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diate continuous passive motion after autogenous patellar tendon reconstruction of the ACL. Patients were randomized into two groups—CPM and non-CPM. The results showed less swelling and effusion, less pain medication and greater knee extension in the CPM group.¹⁰

TOTAL KNEE ARTHROPLASTY

Title: Continuous Passive Motion in the Postoperative Treatment of Patients with Total Knee Replacement. A Retrospective Study

Source: *Phys Ther* 67(1): 39-42, Jan 1987

Author: Gose JC

Overview: JC Gose performed a study in 1987 to evaluate the effects of adding three 1-hour sessions of CPM each day to the entire postoperative program of patients who received a total knee replacement. The data analysis compared the following variables for 32 patients who received CPM and 23 patients who received no CPM: the length of hospital stay (LOS), the number of postoperative days (PODs) before discharge, the frequency of postoperative complications, and the knee range of motion at discharge. The CPM group showed significant decreases in the frequency of complications, the LOS, and in the number of PODs. These results support the use of postoperative applications of CPM, but not as strongly as those reported from studies that used longer periods of CPM.²

Title: Value of Continuous Passive Motion in Total Knee Arthroplasty

Source: *Orthopedics* 13 (3): 291-5, Mar 1990

Authors: Wasilewski SA, Woods LC, Torgerson WR Jr, Healy WL

Overview: In a study performed by Wasilewski (1990) two methods of rehabilitation were reviewed. Patients were divided into groups: one treated with 3 days of immobilization followed by a program of active assisted range-of-motion exercises, and the other placed in a CPM immediately after TKA operation. Patients in the CPM group were found to have a lower incidence of complications, reduced use of analgesics, and earlier achievement of straight leg raising than the non-CPM group. Patients treated with CPM averaged 9 points higher on a 100-point knee rating scale than patients not treated with CPM. In addition, the length of hospital stay for patients in the CPM group was 2.1 days shorter. The authors concluded that CPM was an effective adjunct to physiotherapy in the postoperative care of patients undergoing TKA.⁷

Title: A Controlled Evaluation of Continuous Passive Motion in Patients undergoing TKA

Source: *JAMA* 268 (11): 1423-8, Sept 16, 1992

Author: McInnes J, Larson MG, Daltroy LH, Brown T, Fossel AH, Eaton HM, Shulman-Kirwan



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B, Steindorf S, Poss R, Liang MH

Overview: A study done by McInnes et al. (1992) evaluated the efficacy of CPM in the postoperative management of patients undergoing TKA. The authors measured active flexion, active and passive extension, pain, swelling, quadriceps strength, the need for manipulations, and length of hospital stay. Use of CPM resulted in a net savings of \$6764 over conventional rehabilitation in achieving the results found in the study. The conclusion was that for the average patient undergoing TKA, CPM is more effective in improving range of motion, decreasing swelling, and reducing the need for manipulation than is conventional therapy and lowers cost.³

References and Additional Studies

ARTICULAR CARTILAGE

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