

# CLINICAL STUDIES ON COLD AND COMPRESSION THERAPY

## 1. Cryocompression Therapy After Elective Arthroplasty of the Hip

Leegwater NC, et al., Hip Int 22(05): 527-33, 2012.

***Intermittent cryocompression delivered by the Game Ready System reduces postoperative blood loss. A trend towards less analgesic use, shorter hospital stay, less wound discharge and less pain at 6 weeks postoperatively was also observed.***

A pilot study was conducted where patients were randomized into two groups to measure the effects of combined cyclic compression and cryotherapy in total hip arthroplasty (THA). The 14 control patients received an absorbing bandage and tricot compression bandage. The 12 cryocompression patients received the same type of dressing and intermittent cryocompression therapy 4 times per day for 30 minutes. Post-operative pain, morphine usage, blood loss, wound discharge, patient and medical staff satisfaction together with the feasibility of a cryocompression machine; total hospital admission time, infection rate, deep vein thrombosis and short-term prosthesis related problems were observed.

The advantage of cryocompression therapy in postoperative blood loss reduction was demonstrated. “When compared at POD 1, study group patients had a 0.55 mmol/L (statistically significant) smaller decline in haemoglobin level. At POD 3 this advantage in haemoglobin levels persisted (0.47 mmol/L smaller decline in study group patients)”

“A trend occurred towards lower morphine usage, shorter hospital admission time and less wound discharge in the study group.” Along with “a trend towards less analgesic use, shorter hospital stay, less wound discharge and less pain at 6 weeks postoperatively”.

## 2. A Prospective, Multi-center, Randomized Trial to Evaluate the Efficacy of a Cryopneumatic Device on Total Knee Arthroplasty Recovery

Su EP, et al., J Bone Joint Surg Br 94-B(11): 153-6, 2012.

***The use of the Game Ready system after TKA decreases narcotic consumption and increases patient satisfaction.***

A prospective, multi-center, randomized trial was performed to evaluate the effect of the Game Ready system, a cryopneumatic device on 280 post-operative TKA patients. Patients were evaluated for range of motion, knee girth, six minute walk test (6MWT) and timed up and go test at two and six weeks postoperatively. Visual analog pain scores and narcotic consumption were also measured.

“A cryopneumatic device used after TKA appeared to decrease the need for narcotic medication from hospital discharge to 2 weeks post-operatively. There was also a trend toward a greater distance walked in the 6MWT. Patient satisfaction with the cryopneumatic cooling regimen was significantly higher than with the control treatment.”

## 3. The Efficacy of Combined Cryotherapy and Compression Compared to Cryotherapy Alone Following Anterior Cruciate Ligament Reconstruction

Waterman BR, et al., J Knee Surg 1538-8506, 2012.

***The use of combined cryotherapy and compression delivered by the Game Ready System in the postoperative period after ACL reconstruction results in improved short-term pain relief and a greater likelihood of independence from narcotic use compared with cryotherapy alone.***

A randomized, prospective clinical trial was conducted to evaluate the effectiveness of cryotherapy with or without intermittent pneumatic compression after arthroscopic ACL reconstruction comparing Game Ready® and conventional ice pack therapy at preoperative, 1 week, 2 weeks and 6 weeks postoperative. All patients were required to use cryotherapy at least 3x30 minutes daily. Compliance, usage of pain medications, VAS scores, swelling (girth), quality of life and knee scores were measured.

“During weeks 1 and 2, patients with compressive cryotherapy had 100% (n=18) compliance with use compared with 83% (n=18) of the control group (p=0.23).”

“Baseline VAS for group 1 was 54.9 compared with group 2 at 35.6 (p=0.01). By 6 weeks, this had lowered to 28.1 and 40.3 respectively, resulting in a significant 27-point decrease in mean VAS for group 1 (p<0.0001).”

“At 6 weeks postoperatively, 15 of 18 (83.3%) of all patients in the compressive cryotherapy group had discontinued use of all pain medication, compared with 5 of 18 patients (27.8%) in the control group (p=0.0008).”

## 4. Rehabilitation of the Rotator Cuff: An Evaluation-Based Approach

Millett PJ, et al., J Am Acad Orthop Surg 2006; 14:599-609.

***The use of cryotherapy for days 1-6 for pain and inflammation and days 7-28 as needed for pain control and inflammation are recommended per this evidence-based medicine review.***

In a review of 43 articles reporting various Level I or Level II prospective randomized studies, anatomic or biomechanical studies, case-controlled studies and expert opinion, an assessment of the management and rehabilitation of rotator cuff disease was devised.

## 5. A Comparison of Crushed Ice and Continuous Flow Cold Therapy

Barber FA, Am J Knee Surg 13(2): 97-101, 2000.

***Continuous-flow cold is superior to crushed ice for outpatient ACL reconstruction pain and should not be considered an equivalent modality.***

In a study comparing two groups, each a prospective series of consecutive patients of Plano Orthopedic and Sports Medicine Center, Group 1 was assigned the use of continuous-flow cold therapy and Group 2 was assigned crushed ice secured to the knee with an elastic wrap in the immediate post-operative period, continuing for the first 7 days.

“Crushed ice was compared to continuous-flow cold therapy for control of postoperative pain after arthroscopic...anterior cruciate ligament (ACL) reconstruction. Compared to crushed ice, continuous-flow cold therapy lowered VAS and Likert pain scores more, reduced hydrocodone bitartrate with acetaminophen use, was used more often, increased continuous passive motion, increased 1-week knee flexion, and was given significantly higher performance ratings by patients. Continuous-flow cold is superior to crushed ice for outpatient ACL reconstruction pain and should not be considered an equivalent modality.”

## **6. Continuous-Flow Cold Therapy After Total Knee Arthroplasty**

Morsi E, J Arthroplasty 17(6): 718-22, 2002.

***Continuous cryo group had better outcomes in all endpoints measured.***

This was a single-center, prospective comparative study on the effects of continuous cryotherapy on total knee arthroplasty, where published reports are limited and controversial. In this study 30 patients with staged bilateral TKAs were enrolled in two study groups. Group 1 comprised 30 patients with the first TKA procedure using continuous cooling therapy following the procedure. Group 2 comprised the same 30 patients scheduled for their second TKA procedure (performed 6 weeks following the first one) using no cooling therapy.

“The study compared the range of motion, the volume of hemovac output and blood loss, visual analog pain score, analgesic consumption, and wound healing in the 2 limbs of the same patient. This study showed that continuous-flow cold therapy is advantageous after TKA because it provides better results in all the areas compared.”

## **7. The Efficacy of Cryotherapy in the Postoperative Shoulder**

Speer KP, et al., J Shoulder Elbow Surg 5(1): 62-8, 1996.

***This study reports less pain and swelling, greater patient comfort, and enhanced rehabilitation with cryotherapy for postoperative shoulder surgery.***

This prospective, randomized study included 50 consecutive patients who underwent shoulder surgery and then were admitted to the hospital for at least one night after the procedure. All the procedures were performed by the same surgeon.

This outcomes study “used visual analog scales to evaluate the efficacy of cryotherapy in the postoperative shoulder.” In the cryotherapy group, patients reported less severe pain, less frequent pain, better sleep and less perceived need for pain meds. “By postoperative day 10, patients in the cryotherapy group reported their shoulders hurt less often and with less severity. Swelling was less, and shoulder movement hurt less during rehabilitation, enhancing the rehabilitative effort. Cryotherapy offers a number of benefits for care of patients in the immediate postoperative period.”

## **8. Combination of Cold and Compression After Knee Surgery: A Prospective Randomized Study**

Schroder D, Passler HH. Knee Surg Sports Traumatol Arthrosc 2(3): 158-65, 1994.

***The cold/compression group reported significantly less swelling and pain than the cold-alone group.***

In a prospective and randomized study at Sportklinik, Stuttgart, Germany, the effect of continuous long-term application of a combined cooling and compression system was investigated. The study compared postoperative therapy using a combined cooling and compression system to ice bag therapy only. Postoperative swelling, ROM, subjective pain, consumption of analgesics, and return of function after anterior cruciate ligament (ACL) reconstruction were documented and patients were observed for any adverse effects, such as deep vein thrombosis.

The “effect of continuous long-term application of a combined cooling and compression system” was compared to traditional ice therapy following anterior cruciate ligament (ACL) reconstruction. Study endpoints included “postoperative swelling, range of motion (ROM), pain, consumption of analgesics, and return of function.” In the cold and compression patient group, less pain and swelling was observed compared to the control group. “The evidence from our study shows that continuous combined cold-compression therapy has a number of advantages over cold therapy alone following ACL reconstruction.”

## **9. The Role of Cold Compression Dressings in the Postoperative Treatment of Total Knee Arthroplasty**

Levy AS, Marmar E. Clin Orthop Relat Res (297): 174-8, 1993.

***The use of cold and compression results in a dramatic decrease in blood loss and improvements in early return of motion and decreased narcotic use.***

A prospective randomized study was performed to evaluate the role of cold compressive dressings in the postoperative treatment of 100 consecutive knees in 90 patients treated with total knee arthroplasty (TKA). Eighty unilateral and 10 bilateral patients participated in this study.

“Cold compression provides significant benefits to the patient undergoing TKA. These include a dramatic decrease in blood loss, diminished swelling, lessened pain, and improved early range of motion.”

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Leegwater NC, et al., Hip Int 22(05): 527-33, 2012.

See article #1 in Peer-Reviewed Section for summary.

**2. A Prospective, Multi-center, Randomized Trial to Evaluate the Efficacy of a Cryopneumatic Device on Total Knee Arthroplasty Recovery**

Su EP, et al. Presented at the Winter 2011 Current Concepts in Joint Replacement Meeting. Orlando, FL, December 2011.

See article #2 in Peer-Reviewed Section for summary.

**3. The Efficacy of Combined Cryotherapy and Compression Compared to Cryotherapy Alone Following Anterior Cruciate Ligament Reconstruction**

Waterman BR, et al., Presented at American Academy of Orthopaedic Surgeons, Annual Meeting 2011.

See article #3 in Peer-Reviewed Section for summary.

**4. Intermittent Cryo-Compression Therapy in the Football Athlete**

Kai Mithoefer, MD. Presented at The International Conference on Sports Rehabilitation and Traumatology Health for the Football Player: Prevention, Diagnosis, Surgery and Rehabilitation, 2011.

***Intermittent Cold Compression facilitates recovery [and] return to play.***

An expert opinion reporting two case studies illustrating the benefits of the use of intermittent cold and compression (Game Ready®) for the treatment of the sort of injuries common to football (soccer) athletes. The author reports observing a shorter recovery from ACL injury at ~1 month.

“Routine use [of intermittent cold and compression is] recommended in football athletes.”

**5. Active Cooling and Intermittent Pneumatic Compression Device vs. Standard Cold Therapy after Knee Arthroscopy**

Goradia VK, Warnock N. (2007): Presented at Arthroscopy Association of North America, April 2007.

***Following knee arthroscopy, an active cooling and compression device showed improved range of motion at 2 and 4 weeks postoperatively compared to standard cold therapy.***

A single-center, prospective randomized clinical trial was conducted at a sports medicine clinic. Forty patients were randomized to receive either Game Ready® or Dura-Kold® after undergoing knee arthroscopy with partial meniscectomy and/or chondroplasty. Patients with grade IV chondromalacia or those receiving other treatment were excluded. Clinical measurements included knee girth, active flexion, and active extension. Pain was measured using a self-reported Visual Analogue Scale.

“Following knee arthroscopy, an active cooling and compression device showed improved range of motion at 2 and 4 weeks postoperatively compared to standard cold therapy. Reduction in swelling and pain were comparable between treatment groups.”

**6. The Effects of Continuous Cooling and Cyclical Compression on Intramuscular and Surface Temperatures of the Distal Quadriceps**

Womochel KS, et al., Southwest Athletic Trainers’ Association Annual Meeting. Arlington, TX, July 2007.

First Prize Student Competition.

***A study of the effects of continuous circulating water and cyclical compression on muscle and skin temperature in the distal quadriceps after a 30-minute treatment and 30-minute re-warming in 16 healthy volunteers showed Game Ready® with [cyclic] compression seem[ed] to have a greater magnitude and longer duration of cooling than Polar Care®.***

The purpose of this study was to investigate the effects of continuous circulating water and compression on muscle and skin temperature in the distal quadriceps after a 30-minute treatment and 30-minute re-warming. At the Exercise Science Research Laboratories at the University of Texas at Arlington, a thermocouple was inserted 1.5 cm below subcutaneous adipose tissue in healthy subjects. During treatments, intramuscular temperature was sampled and a skin thermocouple sampled surface temperature. Visual analog scales (VAS) were used to record patients’ perceived sensations (0=no cold & 10=very cold) at 5-minute intervals.

“Game Ready® with [cyclic] compression seem[ed] to have a greater magnitude and longer duration of cooling than Polar Care®.”