

114° CONGRESSO  
INTERNAZIONALE  
S.O.T.I.M.I. - S.A.T.O. - S.O.MU.C.O.T. - S.C.C.O.T

NEW  
TREND  
SOTIMI

# Crioterapia per protesi di ginocchio



Andrea Baldini  
Istituto IFCA – GIOMI, Firenze



## Cryotherapy—As Ancient as the Pharaohs

Eric Maranda, BS; Brian J. Simmons, BS; Paolo Romanelli, MD

In cryotherapy, also known as cryosurgery, cold temperatures are used to treat a wide variety of skin disease in modern dermatology. However, cryotherapy has its humble roots as far back as the Egyptians in 3000 BCE, when cold compresses were used to treat the inflammation of infected wounds.<sup>1</sup> In the fifth century BCE, Hannibal's Carthaginian mercenaries experienced the hemostatic and destructive tissue effects of the cold while crossing the Alps en route to Rome.<sup>2</sup> In the Napoleonic times, cooling was used for anesthesia and amputation. It was not until the mid-1800s when

panded the field by making liquid nitrogen readily available.<sup>2</sup> To fix the problem of inadequate penetration of tissue freezing with available techniques, solid copper discs cooled by submersion in liquid nitrogen became widespread practice. In the mid-20th century, the dermatologists and innovators Douglas Torre and Setrag Zacarian created the first handheld cryosurgery device and brought the first commercial device to market.<sup>3</sup> These pioneers, along with a handful of others, established the field of dermatologic cryosurgery as it is known today.

From the early observations of the Egyptians and Greeks to the more

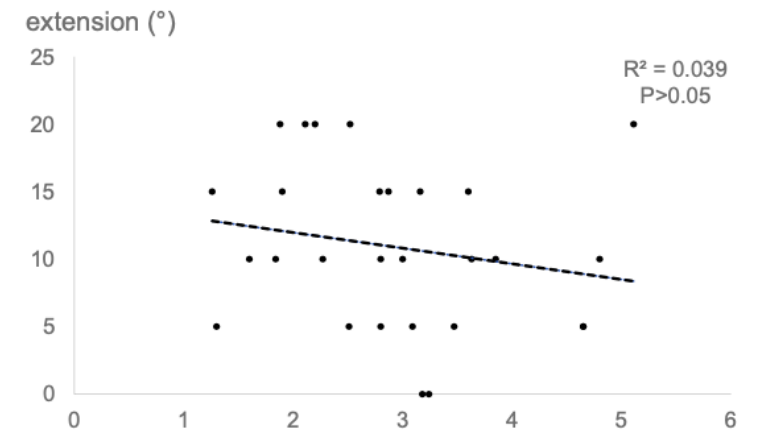
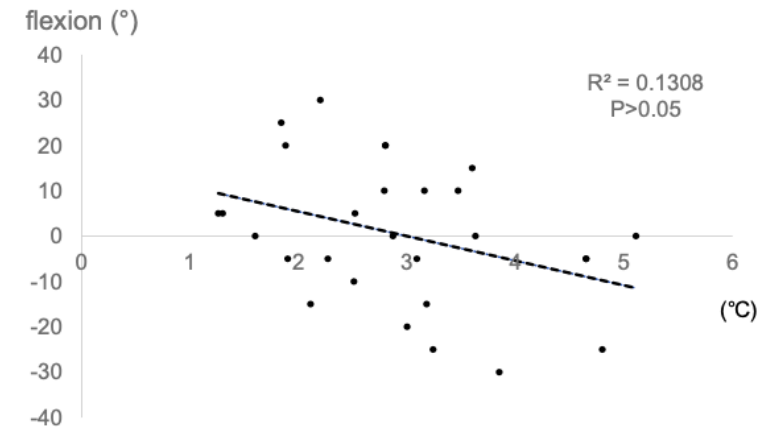
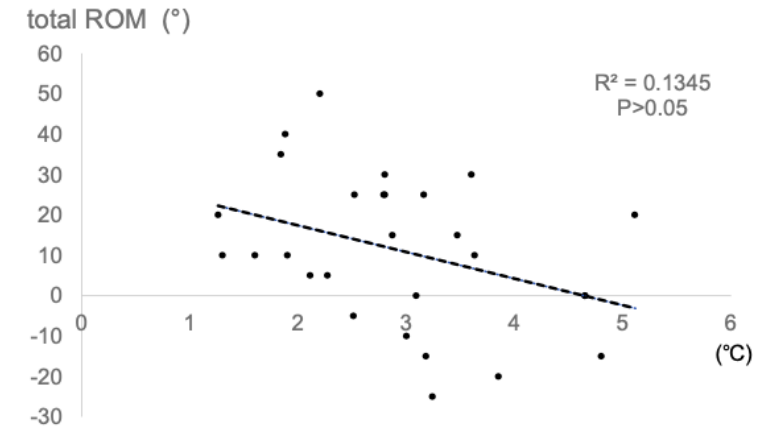
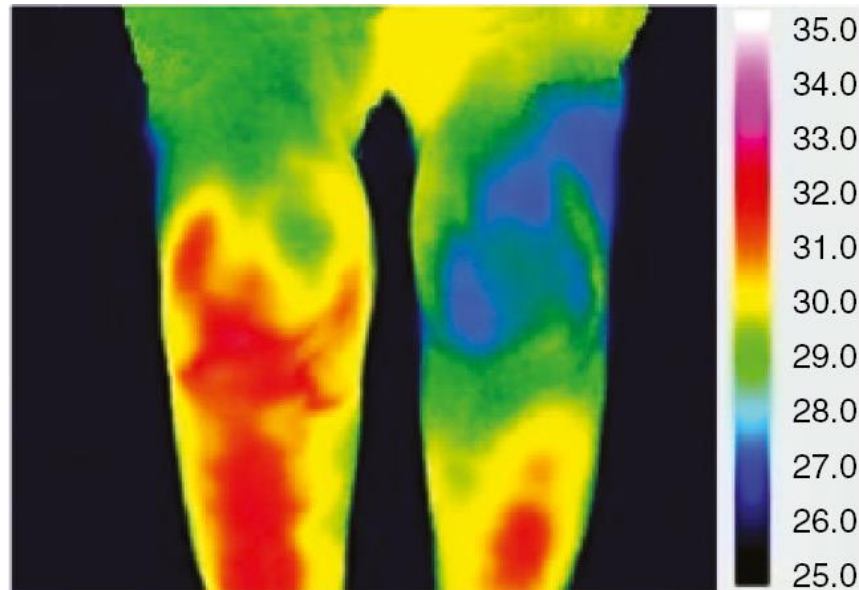
# Cryotherapy mechanism of action

1. Lewis Hunting reaction (vasoconstriction)
2. Van't Hoff Law (1/8 less chemical reactions for each 1°)
3. Decreases capillar permeability by vasocostriction
4. "Gate" theory on pain reduction via cold stimulus to posterior horn cells
5. Reduced local neural conduction
6. Increase excitatory bias on the anterior horn cells for quicker muscle response
7. Reduces bacteria growth

SCIENTIFIC RESEARCH ARTICLE (ORIGINAL ARTICLE)

# Alterations in deep tissue temperature around the knee after total knee arthroplasty: its association with knee motion recovery in the early phase

Misaki UYAMA, PT, Daisuke TAKAMURA, PT, Rina NAKAJIMA, PT, Jumpei HARADA, PT, Kentaro IWATA, PT, Toshio MAEKAWA, PT, Koichi IWAKI, MD and Tadashi YASUDA, MD, PhD



COPYRIGHT © 2011 BY THE JOURNAL OF BONE AND JOINT SURGERY, INCORPORATED

# Temperature-Sensitive Release of Prostaglandin E<sub>2</sub> and Diminished Energy Requirements in Synovial Tissue with Postoperative Cryotherapy

A Prospective Randomized Study After Knee Arthroscopy

Anders Stålmán, MD, PhD, Lukas Berglund, MD, Elisabeth Dungenrc, BSC, Peter Arner, MD, PhD,  
and Li Felländer-Tsai, MD, PhD

*Investigation performed at the Divison of Orthopedics, Department of Clinical Science Intervention and Technology,  
Karolinska Institutet, Stockholm, Sweden*

# Compression enhances Cryotherapy

Compression decreases the pressure gradient  
between blood vessels and tissues and discourages  
further leakage from capillaries

# First generation



# 10 years ago...

## **Cryotherapy following total knee replacement**



Sam Adie<sup>1,2</sup>, Amy Kwan<sup>2</sup>, Justine M Naylor<sup>1,2</sup>, Ian A Harris<sup>1,2</sup>, Rajat Mittal<sup>1,2</sup>

<sup>1</sup>Whitlam Orthopaedic Research Centre, Liverpool Hospital, Liverpool, Australia. <sup>2</sup>South West Sydney Clinical School, University of New South Wales, Liverpool, Australia

The Journal of Arthroplasty Vol. 25 No. 5 2010

### **Cryotherapy After Total Knee Arthroplasty**

A Systematic Review and Meta-Analysis of Randomized  
Controlled Trials

Sam Adie, BSc(Med), MBBS, MSpMed, \*† Justine M. Naylor, BAppSc, PhD, \*† and  
Ian A. Harris, MBBS, MMed (Clin Epi), PhD, FRACS\*†

## No significant differences in outcomes

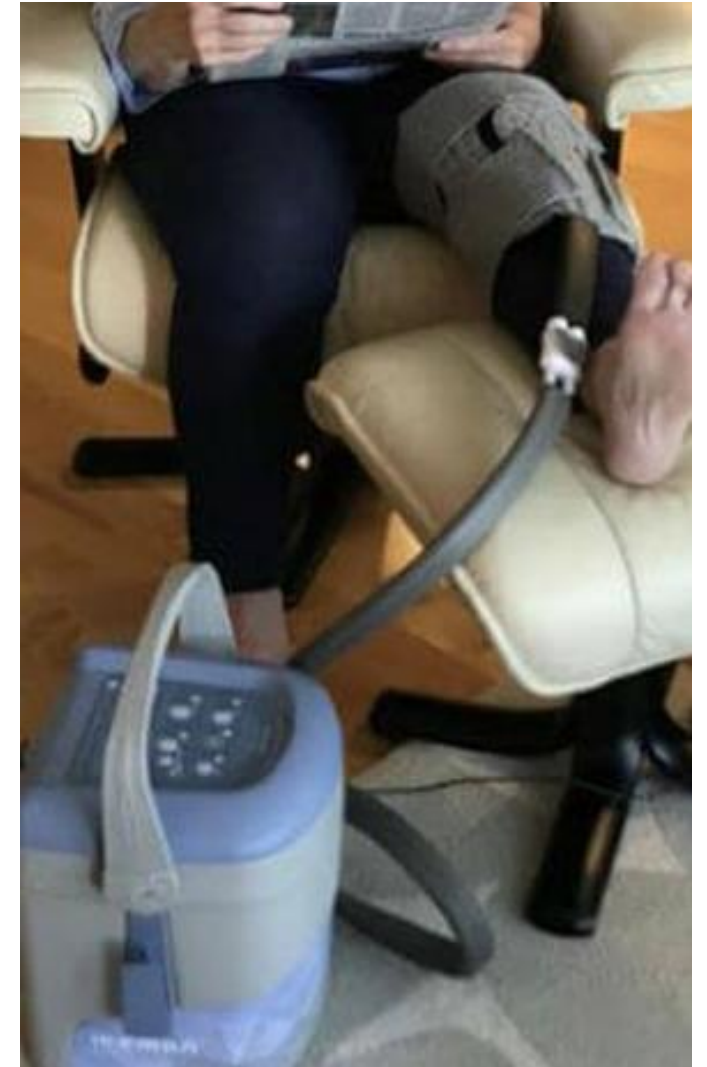


# Comparison of a Continuous Temperature-Controlled Cryotherapy Device to a Simple Icing Regimen Following Outpatient Knee Arthroscopy

---

Shane K. Woolf, MD  
William R. Barfield, PhD  
Keith D. Merrill, MD  
Angus M. McBryde, Jr, MD

# Second generation



# Controversial results

Clin Orthop Relat Res (2014) 472:3417–3423  
DOI 10.1007/s11999-014-3810-8

Clinical Orthopaedics  
and Related Research®  
A Publication of The Association of Bone and Joint Surgeons®

CLINICAL RESEARCH

## Does Advanced Cryotherapy Reduce Pain and Narcotic Consumption After Knee Arthroplasty?

Emmanuel Thienpont MD, MBA

Knee Surgery, Sports Traumatology, Arthroscopy  
<https://doi.org/10.1007/s00167-018-4962-y>

KNEE



## Reduced opiate use after total knee arthroplasty using computer-assisted cryotherapy

Elke Thijs<sup>1</sup> · Martijn G. M. Schotanus<sup>1</sup> · Yoeri F. L. Bemelmans<sup>1</sup> · Nanne P. Kort<sup>2</sup>

Received: 4 January 2018 / Accepted: 23 April 2018

© European Society of Sports Traumatology, Knee Surgery, Arthroscopy (ESSKA) 2018





## ■ TECHNIQUES IN KNEE RECONSTRUCTION

# A prospective, multi-center, randomised trial to evaluate the efficacy of a cryopneumatic device on total knee arthroplasty recovery

E. P. Su,  
M. Perna,  
F. Boettner,  
D. J. Mayman,  
T. Gerlinger,  
W. Barsoum,  
J. Randolph,  
G. Lee

**Pain, swelling and inflammation are expected during the recovery from total knee arthroplasty (TKA) surgery. The severity of these factors and how a patient copes with them may determine the ultimate outcome of a TKA. Cryotherapy and compression are frequently used modalities to mitigate these commonly experienced sequelae. However, their effect on range of motion, functional testing, and narcotic consumption has not been well-studied.**

**A prospective, multi-center, randomised trial was conducted to evaluate the effect of a cryopneumatic device on post-operative TKA recovery. Patients were randomised to treatment with a cryopneumatic device or ice with static compression. A total of 280**

JBJS-B 2012

Game Ready decreased the need for narcotic medication

There was also a trend toward a greater distance walked in the 6MWT.

Patient satisfaction was significantly higher



Multimodal fast-track protocol since 2013



REVIEW

Open Access



# Compressive cryotherapy versus cryotherapy alone in patients undergoing knee surgery: a meta-analysis

Mingzhi Song<sup>1,2†</sup>, Xiaohong Sun<sup>1,3†</sup>, Xiliang Tian<sup>1</sup>, Xianbin Zhang<sup>4</sup>, Tieying Shi<sup>3</sup>, Ran Sun<sup>3,5\*</sup> and Wei Dai<sup>3,5\*</sup>

Compressive cryotherapy is beneficial to patients undergoing knee surgery at the early rehabilitation stage

KNEE

# **Cryotherapy on postoperative rehabilitation of joint arthroplasty**

**Sheng-Hui Ni · Wen-Tong Jiang ·  
Lei Guo · Yu-Heng Jin · Tian-Long Jiang ·  
Yuyan Zhao · Jie Zhao**

Decreased blood loss .

Decreased pain at the second day of postoperative



# Third generation



Ruffilli, J Knee Surg 2016







# Role of preoperative cryocompression?



Intraoperative  
bone temperature  
18-20°

## *History of Neurosurgery* **Cold as a therapeutic agent**

**H. Wang<sup>1</sup>, W. Olivero<sup>1</sup>, D. Wang<sup>2</sup>, and G. Lanzino<sup>1</sup>**

<sup>1</sup> Department of Neurosurgery, Illinois Neurological Institute, University of Illinois College of Medicine at Peoria, Peoria, Illinois, USA

<sup>2</sup> Department of Neurology, Illinois Neurological Institute, University of Illinois College of Medicine at Peoria, Peoria, Illinois, USA

Received February 1, 2005; accepted June 14, 2005; published online February 17, 2006

© Springer-Verlag 2006



Article

# <sup>1</sup>H-NMR-Based Analysis for Exploring Knee Synovial Fluid Metabolite Changes after Local Cryotherapy in Knee Arthritis Patients

Wafa Douzi <sup>1,†</sup>, Xavier Guillot <sup>2,†</sup>, Delphine Bon <sup>3</sup>, François Seguin <sup>3</sup>, Nadège Boildieu <sup>3</sup>, Daniel Wendling <sup>4</sup>, Nicolas Tordi <sup>5</sup>, Olivier Dupuy <sup>1</sup> and Benoit Dugué <sup>1,\*</sup>

Guillot et al. *Arthritis Research & Therapy* (2019) 21:180  
<https://doi.org/10.1186/s13075-019-1965-0>

Arthritis Research & Therapy

RESEARCH ARTICLE

Open Access

Local ice cryotherapy decreases synovial interleukin 6, interleukin 1 $\beta$ , vascular endothelial growth factor, prostaglandin-E2, and nuclear factor kappa B p65 in human knee arthritis: a controlled study



X. Guillot<sup>1,2,3\*</sup>, N. Tordi<sup>2</sup>, C. Laheurte<sup>4</sup>, L. Pazart<sup>5</sup>, C. Prati<sup>2,3</sup>, P. Saas<sup>4</sup> and D. Wendling<sup>3,6</sup>

# Preoperative Cryotherapy Use in Anterior Cruciate Ligament Reconstruction

Loukas Koyonos, MD<sup>1</sup> Kevin Owsley, MD<sup>2</sup> Emily Vollmer, BS<sup>3</sup> Orr Limpisvasti, MD<sup>1</sup>  
Ralph Gambardella, MD<sup>1</sup>

<sup>1</sup> Department of Sports Medicine, Kerlan Jobe Orthopaedic Clinic, Los Angeles, California

<sup>2</sup> Department of Sports Medicine, Orthopedic Surgery Associates of North County, Poway, California

<sup>3</sup> Department of Research, Kerlan Jobe Orthopaedic Clinic, Los Angeles, California

**Address for correspondence** Loukas Koyonos, MD, Department of Sports Medicine, Kerlan Jobe Orthopaedic Clinic, 6801 Park Terrace, Suite 140, Los Angeles, CA 90045 (e-mail: loukaskoyonosmd@gmail.com).

J Knee Surg 2014;27:479–484.

less pain (average 1.3 units,  $p < 0.02$ ) and used less narcotic use (average 1.7 tablets,  $p < 0.02$ ) for the first 36 hours compared with group 1



Media T° cute lato sano 33,5°

Media T° cute lato crio 14,4°

Media T° osso lato crio 21,4°

Criocompressione preop

Controlli

VES	9,6	22,8
PCR	52	63
Fibrinogeno	450	500
D-Dimero	1500	1100

Raggiungimento parametri di dimissibilità (scale, trasferimenti, ecc..)

Crio preop.      Giorno 1,08

Controlli        Giorno 1,35