

# ΔVΔNOS

# GAME READY CLINICAL COMPENDIUM

|                                      |    |
|--------------------------------------|----|
| Shoulder                             | 4  |
| Spine                                | 6  |
| Hip & Leg                            | 8  |
| Knee                                 | 11 |
| Recovery & Athletics                 | 18 |
| Science                              | 21 |
| Safety & Adverse Events              | 25 |
| Review Articles & Clinical Education | 27 |

The Clinical Compendium consists of a literature summary surrounding the use of the GAME READY GRPro 2.1, Med4 Elite, and predicate devices. It is an abridged list of studies, and readers are advised to review all relevant sources for complete information. Study summaries are organized by patient population and include a link to the abstract on PubMed (National Library of Medicine).

## SELECTION CRITERIA FOR STUDY SUMMARIES:

- GAME READY published literature in peer-reviewed journals
- Study designs:
  - Prospective
  - Retrospective
  - Meta-Analysis
- Studies available in the English language
- Exclusion criteria:
  - Poster presentations
  - Abstracts
  - Study protocols
- Categories:
  - Studies by anatomical location
  - Recovery & athletics
  - Science
  - Safety & adverse events
  - Review articles & clinical education

This compendium is a balance of favorable, neutral, and unfavorable studies proportional to the number published in the literature.

## ABBREVIATIONS:

- **ACL** – Anterior Cruciate Ligament
- **CC** – Cryo-Compression
- **DOMS** – Delayed-Onset Muscle Soreness
- **KOOS** – Knee Injury and Osteoarthritis Outcome Score
- **ROM** – Range of Motion
- **THA** – Total Hip Arthroplasty
- **TKA** – Total Knee Arthroplasty
- **VAS** – Visual Analog Scale

## READING THE CLINICAL COMPENDIUM: A SAMPLE GUIDE

| Author                      | Year Published   | Journal       | Type               |
|-----------------------------|--|---------------|--------------------|
| Lead Author Last Name       | Publication Year   | Journal Title | Type of Manuscript |
| <b>Title</b>                | <i>Full Title of the Manuscript</i>  |               |                    |
| <b>Publication Overview</b> | A background in what the study was investigating or discussing                   |               |                    |
| <b>Summary Points</b>       | Take-home points that are supported by the data contained within the publication |               |                    |
| <b>Link to Manuscript</b>   | Link   |               |                    |

In the corner, you will see one of the following icons, which indicate if a study directly mentions GR, CC devices, or contrast therapy devices.



Study uses a GR device (no specific model called out)




Study investigates CC devices with no manufacturer named




Study that reviews contrast therapy devices with no manufacturer named

# SHOULDER


# SHOULDER


| Author                      | Year Published   | Journal                               | Type                        |  |
|-----------------------------|--|---------------------------------------|-----------------------------|---|
| Kraeutler                   | 2015   | Journal of Shoulder and Elbow Surgery | Randomized Controlled Trial |   |
| <b>Title</b>                | <i><a href="#">Compressive Cryotherapy Versus Ice-A Prospective, Randomized Study on Postoperative Pain in Patients Undergoing Arthroscopic Rotator Cuff Repair or Subacromial Decompression</a></i>                       |                                       |                             |   |
| <b>Publication Overview</b> | Study to compare the efficacy of CC therapy versus ice on postoperative pain in patients undergoing shoulder arthroscopy for rotator cuff repair or subacromial decompression.   |                                       |                             |   |
| <b>Summary Points</b>       | No significant post-operative pain relief benefits were found in patients who used CC therapy versus ice. No significant differences were found in average pain, worst pain, or morphine equivalent dosage post-procedure. |                                       |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/25825138/">https://pubmed.ncbi.nlm.nih.gov/25825138/</a>  |                                       |                             |   |

| Author                      | Year Published  | Journal                               | Type              |  |
|-----------------------------|---|---------------------------------------|-------------------|---|
| Dickinson                   | 2017  | Journal of Shoulder and Elbow Surgery | Systematic Review |   |
| <b>Title</b>                | <i><a href="#">A Systematic Review of Cost-Effective Treatment of Postoperative Rotator Cuff Repairs</a></i>                                    |                                       |                   |   |
| <b>Publication Overview</b> | Study to evaluate cost-effective, high-quality postoperative rehabilitation dosing and cryotherapy for patients undergoing rotator cuff repair. |                                       |                   |   |
| <b>Summary Points</b>       | Cryotherapy is favorable and cost-effective for patients undergoing rotator cuff repair.  |                                       |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/28314695/">https://pubmed.ncbi.nlm.nih.gov/28314695/</a>   |                                       |                   |   |

# SPINE

# SPINE


| Author                      | Year Published  | Journal    | Type                  |  |
|-----------------------------|---|------------|-----------------------|---|
| Nabiyev                     | 2018  | Neurospine | Cross-Sectional Study |   |
| <b>Title</b>                | <i><u>Cryo-Compression Therapy After Elective Spinal Surgery for Pain Management: A Cross-Sectional Study With Historical Control</u></i>   |            |                       |   |
| <b>Publication Overview</b> | Study to analyze the analgesic efficacy of CC therapy in adult patients following lumbar spinal surgery.  |            |                       |   |
| <b>Summary Points</b>       | A positive association was found between CC therapy and accelerated improvement during early rehabilitation post-procedure compared with patients who were treated with narcotics only. |            |                       |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/30531660/">https://pubmed.ncbi.nlm.nih.gov/30531660/</a>   |            |                       |   |


| Author                      | Year Published  | Journal   | Type                |  |
|-----------------------------|---|---|---------------------|---|
| De Bie                      | 2021  | Orthopaedics & Traumatology, Surgery & Research | Retrospective Study |   |
| <b>Title</b>                | <i><u>Enhanced Recovery After Lumbar Fusion Surgery: Benefits of Using Game Ready®</u></i>  |   |                     |   |
| <b>Publication Overview</b> | Study to evaluate the impact of a CC device on post-procedure analgesia following lumbar fusion.  |   |                     |   |
| <b>Summary Points</b>       | A CC device is an effective method to control post-procedure pain in spine surgery. Device usage decreased the consumption of analgesics, limited blood loss, reduced the need for transfusions, and contributed to enhanced recovery post-procedure. |   |                     |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/33957322/">https://pubmed.ncbi.nlm.nih.gov/33957322/</a>   |   |                     |   |


# HIP & LEG




# HIP & LEG


| Author                      | Year Published  | Journal           | Type           |  |
|-----------------------------|---|-------------------|----------------|---|
| Leegwater                   | 2012  | Hip International | Clinical Trial |   |
| <b>Title</b>                | <a href="#"><i>Cryocompression Therapy After Elective Arthroplasty of the Hip</i></a>   |                   |                |   |
| <b>Publication Overview</b> | Study to evaluate the effects of combined CC in THA.  |                   |                |   |
| <b>Summary Points</b>       | The CC group reported lower morphine usage, shorter hospital admission times, and less wound discharge than control. Intermittent CC appeared to reduce post-procedure blood loss. No difference was found in post-procedure pain scores. |                   |                |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/23112075/">https://pubmed.ncbi.nlm.nih.gov/23112075/</a>   |                   |                |   |

| Author                      | Year Published   | Journal | Type                        |  |
|-----------------------------|--|---------|-----------------------------|---|
| Leegwater                   | 2017   | Injury  | Randomized Controlled Trial |   |
| <b>Title</b>                | <a href="#"><i>Postoperative Continuous-Flow Cryocompression Therapy in the Acute Recovery Phase of Hip Fracture Surgery- A Randomized Controlled Clinical Trial</i></a>   |         |                             |   |
| <b>Publication Overview</b> | Study to evaluate the efficacy of continuous flow CC therapy in the acute recovery phase following hip fracture surgery.   |         |                             |   |
| <b>Summary Points</b>       | A mild analgesic effect was observed at 72 hours post-procedure in patients who completed the continuous flow CC treatment schedule. Continuous flow CC therapy was not found to add value in the acute recovery phase post-procedure. |         |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/29079365/">https://pubmed.ncbi.nlm.nih.gov/29079365/</a>  |         |                             |   |

| Author                      | Year Published   | Journal                             | Type              |  |
|-----------------------------|--|-------------------------------------|-------------------|---|
| Klaber                      | 2019   | Journal of Hip Preservation Surgery | Comparative Study |   |
| <b>Title</b>                | <a href="#"><i>Compressive Cryotherapy is Superior to Cryotherapy Alone in Reducing Pain After Hip Arthroscopy</i></a>   |                                     |                   |   |
| <b>Publication Overview</b> | Study to evaluate the effect of CC therapy in pain management and early discharge post-THA.  |                                     |                   |   |
| <b>Summary Points</b>       | The CC group reported lower pain scores during the early post-procedure phase and were discharged to home sooner when compared with the control group. A trend toward lower opioid analgesia usage was observed in the CC group. |                                     |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://academic.oup.com/jhps/article/6/4/364/5610188">https://academic.oup.com/jhps/article/6/4/364/5610188</a>  |                                     |                   |   |


# HIP & LEG


| Author                      | Year Published  | Journal                                    | Type              |  |
|-----------------------------|---|--|-------------------|---|
| Leegwater                   | 2019  | Journal of Orthopedic Surgery and Research | Multicenter Study |   |
| <b>Title</b>                | <i><u>Continuous-Flow Cryocompression Therapy Penetrates to Bone Level in Hip Fracture Patients in a Numerical Simulation</u></i>   |  |                   |   |
| <b>Publication Overview</b> | Study to observe deep tissue temperature during CC in post-procedure hip fracture patients.   |  |                   |   |
| <b>Summary Points</b>       | CC-induced analgesia was found to originate likely from skin analgesia, rather than muscle- or bone-derived pain analgesia. CC reduces temperature up to 3 cm and reaches the bone in cachectic patients, which may have implications for bone tissue healing with prolonged treatment. |  |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/30764844/">https://pubmed.ncbi.nlm.nih.gov/30764844/</a>   |  |                   |   |


| Author                      | Year Published   | Journal                                     | Type                       |  |
|-----------------------------|--|---|----------------------------|---|
| Munsch                      | 2022   | Journal of Clinical Orthopaedics and Trauma | Retrospective Cohort Study |   |
| <b>Title</b>                | <i><u>Patient-Specific Factors, But Neither Regional Anesthesia Nor Hip-specific Cryotherapy, Predict Postoperative Opioid Requirements After Hip Arthroscopy for Femoroacetabular Impingement (FAI) Syndrome</u></i>                                  |   |                            |   |
| <b>Publication Overview</b> | Study to evaluate whether regional nerve blocks, CC delivery systems or patient-specific factors predict post-procedure opioid requirements and pain scores post-THA.  |   |                            |   |
| <b>Summary Points</b>       | Patient-specific factors are strong predictors of post-procedure opioid requirements. Regional nerve blocks and CC delivery systems did not affect opioid prescription amounts, opioid refill requests, and pain-related office visits post-procedure. |   |                            |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/35378774/">https://pubmed.ncbi.nlm.nih.gov/35378774/</a>  |   |                            |   |


# KNEE


# KNEE


| Author                      | Year Published   | Journal                               | Type                        |  |
|-----------------------------|--|---------------------------------------|-----------------------------|---|
| Su                          | 2012   | The Journal of Bone and Joint Surgery | Randomized Controlled Trial |   |
| <b>Title</b>                | <a href="#"><i>A Prospective, Multi-Center, Randomised Trial to Evaluate the Efficacy of a Cryopneumatic Device on Total Knee Arthroplasty Recovery</i></a>  |                                       |                             |   |
| <b>Publication Overview</b> | Study to investigate the efficacy of a CC device on post-TKA recovery.   |                                       |                             |   |
| <b>Summary Points</b>       | The CC device group demonstrated higher satisfaction scores and a greater distances walked at 6 weeks post-procedure. The CC device decreases the need for narcotic medication from hospital discharge to 2 weeks post-procedure. No differences were found in ROM, VAS, adverse events or knee circumference at 6 weeks post-procedure. |                                       |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/23118406/">https://pubmed.ncbi.nlm.nih.gov/23118406/</a>  |                                       |                             |   |

| Author                      | Year Published   | Journal                     | Type                        |  |
|-----------------------------|--|-----------------------------|-----------------------------|---|
| Waterman                    | 2012   | The Journal of Knee Surgery | Randomized Controlled Trial |   |
| <b>Title</b>                | <a href="#"><i>The Efficacy of Combined Cryotherapy and Compression Compared With Cryotherapy Alone Following Anterior Cruciate Ligament Reconstruction</i></a>            |                             |                             |   |
| <b>Publication Overview</b> | Study to compare subjective and objective patient outcomes post-ACL reconstruction with CC versus traditional ice therapy.   |                             |                             |   |
| <b>Summary Points</b>       | CC post-ACL reconstruction demonstrates improved, short-term pain relief and a greater likelihood for independence from narcotic use when compared with cryotherapy alone. |                             |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/22928433/">https://pubmed.ncbi.nlm.nih.gov/22928433/</a>  |                             |                             |   |


| Author                      | Year Published  | Journal   | Type               |  |
|-----------------------------|---|---|--------------------|---|
| Murgier                     | 2014  | Orthopaedics & Traumatology, Surgery & Research | Case-Control Study |   |
| <b>Title</b>                | <a href="#"><i>Cryotherapy With Dynamic Intermittent Compression for Analgesia After Anterior Cruciate Ligament Reconstruction. Preliminary Study</i></a> |   |                    |   |
| <b>Publication Overview</b> | Study to investigate the efficacy of CC in relieving post-procedure pain and restoring ROM post-ACL reconstruction.                                       |   |                    |   |
| <b>Summary Points</b>       | CC decreases analgesic drug requirements post-ACL reconstruction while improving post-procedure ROM recovery.   |   |                    |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/24679367/">https://pubmed.ncbi.nlm.nih.gov/24679367/</a>   |   |                    |   |


| Author                      | Year Published  | Journal                   | Type              |  |
|-----------------------------|---|---------------------------|-------------------|---|
| Martimbianco                | 2014  | Physical Therapy in Sport | Systematic Review |   |
| <b>Title</b>                | <i><a href="#">Effectiveness and Safety of Cryotherapy After Arthroscopic Anterior Cruciate Ligament Reconstruction. A Systematic Review of the Literature</a></i>                            |                           |                   |   |
| <b>Publication Overview</b> | Study to evaluate the efficacy and safety of cryotherapy post-ACL reconstruction.   |                           |                   |   |
| <b>Summary Points</b>       | The use of CC devices significantly reduced pain scores 48 hours post-procedure compared to no cryotherapy. The risk of adverse events did not differ between cryotherapy and control groups. |                           |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/24713365/">https://pubmed.ncbi.nlm.nih.gov/24713365/</a>   |                           |                   |   |

| Author                      | Year Published   | Journal      | Type          |  |
|-----------------------------|--|--------------|---------------|---|
| Song                        | 2016   | Springerplus | Meta-Analysis |   |
| <b>Title</b>                | <i><a href="#">Compressive Cryotherapy Versus Cryotherapy Alone in Patients Undergoing Knee Surgery: A Meta-Analysis</a></i>   |              |               |   |
| <b>Publication Overview</b> | Study to compare the efficacy of CC versus cryotherapy for knee surgery patients.  |              |               |   |
| <b>Summary Points</b>       | CC is beneficial to patients undergoing knee surgery at the early rehabilitation stage. At the final rehabilitation stage, CC and cryotherapy alone demonstrated similar efficacy. |              |               |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/27462522/">https://pubmed.ncbi.nlm.nih.gov/27462522/</a>  |              |               |   |

| Author                      | Year Published  | Journal                     | Type   |  |
|-----------------------------|---|-----------------------------|--------|---|
| Chughtai                    | 2016  | The Journal of Knee Surgery | Review |   |
| <b>Title</b>                | <i><a href="#">Nonpharmacologic Pain Management and Muscle Strengthening Following Total Knee Arthroplasty</a></i>  |                             |        |   |
| <b>Publication Overview</b> | Study to review non-invasive and novel modalities for neuromodulation in the treatment of pain and muscular weakness post-TKA.  |                             |        |   |
| <b>Summary Points</b>       | CC may help alleviate post-TKA pain. Cryotherapy, among other modalities, is a potential adjunct to current standard-of-care pharmacologic treatments to address post-procedure pain and muscle weakness. |                             |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/26683980/">https://pubmed.ncbi.nlm.nih.gov/26683980/</a>   |                             |        |   |


# KNEE


| Author                      | Year Published  | Journal            | Type                        |  |
|-----------------------------|---|--------------------|-----------------------------|---|
| Schinsky                    | 2016  | Orthopedic Nursing | Randomized Controlled Trial |   |
| <b>Title</b>                | <i><a href="#">Multifaceted Comparison of Two Cryotherapy Devices Used After Total Knee Arthroplasty: Cryotherapy Device Comparison</a></i>   |                    |                             |   |
| <b>Publication Overview</b> | Study to compare the efficacy of a CC device versus ice/gel pack cryotherapy wrap post-TKA.   |                    |                             |   |
| <b>Summary Points</b>       | The CC device group demonstrated similar objective patient outcomes and subjective patient satisfaction to the cryotherapy wrap group post-TKA. Hospital staff satisfaction and device costs favor the cryotherapy wraps. |                    |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/27648792/">https://pubmed.ncbi.nlm.nih.gov/27648792/</a>   |                    |                             |   |


| Author                      | Year Published   | Journal                 | Type                |  |
|-----------------------------|--|-------------------------|---------------------|---|
| Mistry                      | 2016   | Journal of Knee Surgery | Clinical Guidelines |   |
| <b>Title</b>                | <i><a href="#">Rehabilitative Guidelines After Total Knee Arthroplasty: A Review</a></i>   |                         |                     |   |
| <b>Publication Overview</b> | Guideline to investigate the role of rehabilitative methods for post-TKA patients.   |                         |                     |   |
| <b>Summary Points</b>       | Most studies suggest that CC therapy is effective for postoperative pain relief and function, particularly as it decreases the metabolic activity of local tissues while providing external support and limiting the accumulation of soft-tissue swelling. |                         |                     |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/26963074/">https://pubmed.ncbi.nlm.nih.gov/26963074/</a>  |                         |                     |   |

| Author                      | Year Published   | Journal  | Type              |  |
|-----------------------------|--|--|-------------------|---|
| Gatewood                    | 2017   | Knee Surgery, Sports Traumatology, Arthroscopy | Systematic Review |   |
| <b>Title</b>                | <i><a href="#">The Efficacy of Post-Operative Devices Following Knee Arthroscopic Surgery: A Systematic Review</a></i>   |  |                   |   |
| <b>Publication Overview</b> | Study to evaluate the efficacy of treatment methods used post-TKA.   |  |                   |   |
| <b>Summary Points</b>       | CC is among treatment methods recommended for inclusion in rehabilitation protocols post-TKA to address pain relieve, recovery of muscle strength and knee function. |  |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/27695905/">https://pubmed.ncbi.nlm.nih.gov/27695905/</a>  |  |                   |   |


# KNEE


| Author                      | Year Published   | Journal                     | Type               |  |
|-----------------------------|--|-----------------------------|--------------------|---|
| Murgier                     | 2017   | The Journal of Arthroplasty | Case-Control Study |   |
| <b>Title</b>                | <i><a href="#">Cryotherapy With Dynamic Intermittent Compression Improves Recovery From Revision Total Knee Arthroplasty</a></i>   |                             |                    |   |
| <b>Publication Overview</b> | Study to investigate the efficacy of CC in relieving post-procedure pain, decreasing blood loss and improving functional scores post-revision TKA.   |                             |                    |   |
| <b>Summary Points</b>       | The CC group reported significantly lower total blood loss, significantly less pain on day 3 and a significantly higher functional score compared with the control group. CC improves recovery for patients post-revision TKA. |                             |                    |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/28465126/">https://pubmed.ncbi.nlm.nih.gov/28465126/</a>  |                             |                    |   |


| Author                      | Year Published  | Journal  | Type        |  |
|-----------------------------|---|--|-------------|---|
| Kacprzak                    | 2020  | Journal of Orthopaedics, Traumatology and Rehabilitation | Pilot Study |   |
| <b>Title</b>                | <i><a href="#">The Jumper's Knee - A New Look At Non-Surgical Treatment. Pilot Study</a></i>  |  |             |   |
| <b>Publication Overview</b> | Study to evaluate the efficacy of a novel conservative treatment approach in the time needed to return to sport.  |  |             |   |
| <b>Summary Points</b>       | A novel conservative treatment approach generated promising results in the treatment of the jumper's knee. A 100% return to sport rate was reported among patients studied. |  |             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/33568571/">https://pubmed.ncbi.nlm.nih.gov/33568571/</a>   |  |             |   |

| Author                      | Year Published   | Journal   | Type                |  |
|-----------------------------|--|---|---------------------|---|
| Sezer                       | 2021   | Orthopaedics & Traumatology, Surgery & Research | Retrospective Study |   |
| <b>Title</b>                | <i><a href="#">Early Postoperative Practices Following Anterior Cruciate Ligament Reconstruction in France</a></i>   |   |                     |   |
| <b>Publication Overview</b> | Study to investigate early post-procedure practices following ACL reconstruction.  |   |                     |   |
| <b>Summary Points</b>       | Early post-procedure practices are related to surgical experience post-ACL reconstruction. The greater the surgical experience, the greater role of joint effusion prevention and self-rehabilitation. |   |                     |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/34537390/">https://pubmed.ncbi.nlm.nih.gov/34537390/</a>  |   |                     |   |

# KNEE


| Author                      | Year Published  | Journal  | Type   |   |
|-----------------------------|---|--|--------|---|
| Mendes                      | 2022  | Therapeutic Hypothermia and Temperature Management | Review |  |
| <b>Title</b>                | <a href="#"><i>Cryotherapy in Anterior Cruciate Ligamentoplasty Pain: A Scoping Review</i></a>  |  |        |   |
| <b>Publication Overview</b> | Study to evaluate the efficacy of cryotherapy on pain intensity in the immediate period post-ACL reconstruction.  |  |        |   |
| <b>Summary Points</b>       | Cryotherapy is an effective treatment method to reduce pain intensity, demonstrating reductions in subjective pain scale scores post-ACL reconstruction. CC was found to be superior to conventional cryotherapy. |  |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/35085042/">https://pubmed.ncbi.nlm.nih.gov/35085042/</a>   |  |        |   |

| Author                      | Year Published   | Journal  | Type                        |   |
|-----------------------------|--|--|-----------------------------|---|
| Marinova                    | 2023   | Knee Surgery, Sports Traumatology, Arthroscopy | Randomized Controlled Trial |  |
| <b>Title</b>                | <a href="#"><i>The Role of a Cryocompression Device Following Total Knee Arthroplasty to Assist in Recovery: A Randomised Controlled Trial</i></a>   |  |                             |   |
| <b>Publication Overview</b> | Study to evaluate the efficacy of a CC device versus usual care protocol on early post-procedure recovery following TKA.   |  |                             |   |
| <b>Summary Points</b>       | No significant differences were observed between the CC device group versus usual care protocol during or after cession of the intervention. The CC group demonstrated significant more knee extension gains during the initial 2 week intervention period, but the cause is undetermined. |  |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/37464101/">https://pubmed.ncbi.nlm.nih.gov/37464101/</a>  |  |                             |   |

| Author                      | Year Published   | Journal                       | Type                        |   |
|-----------------------------|--|-------------------------------|-----------------------------|---|
| Quesnot                     | 2024   | BMC Musculoskeletal Disorders | Randomized Controlled Trial |  |
| <b>Title</b>                | <a href="#"><i>Randomized Controlled Trial of Compressive Cryotherapy Versus Standard Cryotherapy After Total Knee Arthroplasty: Pain, Swelling, Range of Motion and Functional Recovery</i></a>   |                               |                             |   |
| <b>Publication Overview</b> | Study to compare knee ROM at 21 days post-TKA between patients who used CC versus patients who used cryotherapy alone.   |                               |                             |   |
| <b>Summary Points</b>       | Both cryotherapy methods reported improved joint ROM, trophic changes, pain and function. The CC group demonstrated a significantly faster improvement in passive knee flexion ROM, a greater reduction of swelling and lessened pain during activity. Walking distance and KOOS questionnaire were significantly better for the CC group. |                               |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/38419032/">https://pubmed.ncbi.nlm.nih.gov/38419032/</a>  |                               |                             |   |





# KNEE


| Author               | Year Published   | Journal  | Type                        |  |
|----------------------|--|----------|-----------------------------|---|
| Belsey               | 2024   | PloS One | Randomized Controlled Trial |   |
| Title                | <a href="#">A Randomised Crossover Trial of Five Cryocompression Devices' Ability to Reduce Skin Temperature of the Knee</a> |          |                             |   |
| Publication Overview | Study to compare the ability of five CC devices in reducing skin temperature to within a target therapeutic range.           |          |                             |   |
| Summary Points       | Two CC devices reduced skin temperature of the knee within the target therapeutic range of 10-15°C.                          |          |                             |   |
| Link to Manuscript   | <a href="https://pubmed.ncbi.nlm.nih.gov/38227605/">https://pubmed.ncbi.nlm.nih.gov/38227605/</a>                            |          |                             |   |

# RECOVERY & ATHLETICS


# RECOVERY & ATHLETICS


| Author                      | Year Published   | Journal   | Type              |  |
|-----------------------------|--|---|-------------------|---|
| Chan                        | 2016   | Asia-Pacific Journal of Sports Medicine, Arthroscopy, Rehabilitation and Technology | Comparative Study |   |
| <b>Title</b>                | <i><a href="#">Comparison of Different Cryotherapy Recovery Methods in Elite Junior Cyclists</a></i>   |   |                   |   |
| <b>Publication Overview</b> | Study to compare 3 methods to facilitate recovery in elite junior cyclists.  |   |                   |   |
| <b>Summary Points</b>       | No significant difference between average power output, blood lactate, rating of perceived exertion, and heart rate for two time-trial bouts was found between CC therapy, cold water immersion and active recovery treatment. CC therapy, cold water immersion and active recovery treatment are all useful recovery protocols between exercise sessions. |   |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/29264264/">https://pubmed.ncbi.nlm.nih.gov/29264264/</a>  |   |                   |   |

| Author                      | Year Published  | Journal                    | Type   |  |
|-----------------------------|---|----------------------------|--------|---|
| Statuta                     | 2019  | Clinics in Sports Medicine | Review |   |
| <b>Title</b>                | <i><a href="#">Training Room Procedures and Use of Therapeutic Modalities in Athletes</a></i>   |                            |        |   |
| <b>Publication Overview</b> | Study to review current evidence and therapeutic methods used in athletic training rooms.   |                            |        |   |
| <b>Summary Points</b>       | Athletic trainers and physical therapists use a variety of therapeutic methods along with rehabilitation exercises to improve outcomes. Clinicians must be knowledgeable of the evidence for each method to optimize treatments and encourage recovery. |                            |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/31472770/">https://pubmed.ncbi.nlm.nih.gov/31472770/</a>   |                            |        |   |

| Author                      | Year Published  | Journal                         | Type   |  |
|-----------------------------|---|---------------------------------|--------|---|
| Cullen                      | 2021  | Current Sports Medicine Reports | Review |   |
| <b>Title</b>                | <i><a href="#">Passive Recovery Strategies After Exercise: A Narrative Literature Review of the Current Evidence</a></i>  |                                 |        |   |
| <b>Publication Overview</b> | Study to review the mechanisms and benefits for passive recovery strategies post-exercise to optimize athletic recovery.  |                                 |        |   |
| <b>Summary Points</b>       | Compression garments, cold water immersion, and partial body cryotherapy, among other passive recovery techniques, improve athletic recovery. Passive recovery techniques help minimize the negative effects of training and enable the athlete to more quickly return to peak performance. |                                 |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/34234090/">https://pubmed.ncbi.nlm.nih.gov/34234090/</a>   |                                 |        |   |


# RECOVERY & ATHLETICS


| Author                      | Year Published  | Journal          | Type              |  |
|-----------------------------|---|------------------|-------------------|---|
| Alexander                   | 2022  | Biology of Sport | Prospective Study |   |
| <b>Title</b>                | <i><a href="#">Effects of Contemporary Cryo-Compression on Post-Training Performance in Elite Academy Footballers</a></i>   |                  |                   |   |
| <b>Publication Overview</b> | Study to evaluate the immediate effects of CC on physiological and biomechanical measures in elite athletes following a fatiguing training session.   |                  |                   |   |
| <b>Summary Points</b>       | Variable responses following exposure to CC (compared to passive recovery) suggests targeted and individualized recovery strategies are essential. Significant reductions in neuromuscular performance immediately following exposure to pneumatic CC devices may discourage this recovery strategy if neuromuscular mechanisms are required in the short term. |                  |                   |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/35173358/">https://pubmed.ncbi.nlm.nih.gov/35173358/</a>   |                  |                   |   |


| Author                      | Year Published  | Journal | Type   |  |
|-----------------------------|---|---------|--------|---|
| Driller                     | 2023  | Sports  | Review |   |
| <b>Title</b>                | <i><a href="#">Fundamentals or Icing on Top of the Cake? A Narrative Review of Recovery Strategies and Devices for Athletes</a></i>       |         |        |   |
| <b>Publication Overview</b> | Study to review recovery strategies and devices for athletes in relation to the hierarchy of scientific evidence.                         |         |        |   |
| <b>Summary Points</b>       | Cryotherapy and compression garments are among strategies noted to have a high level of positive evidence for improved recovery outcomes. |         |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/37999430/">https://pubmed.ncbi.nlm.nih.gov/37999430/</a>   |         |        |   |

# SCIENCE

# SCIENCE

| Author                      | Year Published   | Journal       | Type               |  |
|-----------------------------|--|---------------|--------------------|---|
| Holwerda                    | 2013   | Sports Health | Experimental Study |   |
| <b>Title</b>                | <i><a href="#">Effects of Cold Modality Application With Static and Intermittent Pneumatic Compression on Tissue Temperature and Systemic Cardiovascular Responses</a></i>   |               |                    |   |
| <b>Publication Overview</b> | Study to investigate whether higher levels of CC reduced tissue temperature and if cold modalities will cause acute increases in cardiovascular strain.  |               |                    |   |
| <b>Summary Points</b>       | The application of CC did not produce acute cardiovascular strain that exceeded the strain produced by standard ice bags/elastic wrap treatment. Greater temperature decreases were achieved with medium- and high-pressure settings when using the CC system. |               |                    |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/24381698/">https://pubmed.ncbi.nlm.nih.gov/24381698/</a>  |               |                    |   |

| Author                      | Year Published   | Journal               | Type   |  |
|-----------------------------|--|-----------------------|--------|---|
| Malanga                     | 2015   | Postgraduate Medicine | Review |   |
| <b>Title</b>                | <i><a href="#">Mechanisms and Efficacy of Heat and Cold Therapies For Musculoskeletal Injury</a></i>   |                       |        |   |
| <b>Publication Overview</b> | Study to review the mechanisms of action, physiological effects, and clinical evidence that supports the clinical use of heat and cold therapies.  |                       |        |   |
| <b>Summary Points</b>       | The physiological effects of cold therapy include reductions in pain, blood flow, edema, inflammation, muscle spasm, and metabolic demand. Some evidence supports the use of cold therapy following acute musculoskeletal injury and DOMS. |                       |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/25526231/">https://pubmed.ncbi.nlm.nih.gov/25526231/</a>  |                       |        |   |

| Author                      | Year Published  | Journal  | Type                        |  |
|-----------------------------|---|--|-----------------------------|---|
| Khoshnevis                  | 2015  | Knee Surgery, Sports Traumatology, Arthroscopy | Randomized Controlled Trial |   |
| <b>Title</b>                | <i><a href="#">Cold-Induced Vasoconstriction May Persist Long After Cooling Ends: An Evaluation of Multiple Cryotherapy Units</a></i>   |  |                             |   |
| <b>Publication Overview</b> | Study to investigate the magnitude and persistence of vasoconstriction associated with cryotherapy.   |  |                             |   |
| <b>Summary Points</b>       | Cryotherapy can create a deep state of vasoconstriction in the local area of treatment. The condition of reduced blood flow persists long after local temperatures have rewarmed towards the normal range. This indicates that maintenance of vasoconstriction is not directly dependent on the continuing existence of a cold state. |  |                             |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/24562697/">https://pubmed.ncbi.nlm.nih.gov/24562697/</a>   |  |                             |   |


# SCIENCE

| Author                      | Year Published  | Journal  | Type             |  |
|-----------------------------|---|----------|------------------|--|
| Karvat                      | 2018  | Einstein | Evaluation Study |  |
| <b>Title</b>                | <i><a href="#">Analysis of the Muscle Tissue of Wistar Rats Submitted to the Sciatic Nerve Compression Model and Cryotherapy</a></i>  |          |                  |  |
| <b>Publication Overview</b> | Study to compare the effects of right sciatic nerve compression and cryotherapy on muscle tissue.   |          |                  |  |
| <b>Summary Points</b>       | Nerve injury reduced strength and muscle trophism (weight, diameter and area). Cryotherapy delayed hypotrophy during its application, but this effect did not last after ceasing treatment. |          |                  |  |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/30231143/">https://pubmed.ncbi.nlm.nih.gov/30231143/</a>   |          |                  |  |

| Author                      | Year Published  | Journal                          | Type              |  |
|-----------------------------|---|----------------------------------|-------------------|--|
| Ostrowski                   | 2019  | Journal of Sports Rehabilitation | Comparative Study |  |
| <b>Title</b>                | <i><a href="#">Effectiveness of Salted Ice Bag Versus Cryocompression on Decreasing Intramuscular and Skin Temperature</a></i>            |                                  |                   |  |
| <b>Publication Overview</b> | Study to compare magnitude of muscle and skin cooling with a slated ice bag versus CC.  |                                  |                   |  |
| <b>Summary Points</b>       | A salted ice bag with elastic wrap compression and CC demonstrated equal intramuscular temperature decreases during the treatment period. |                                  |                   |  |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/29035620/">https://pubmed.ncbi.nlm.nih.gov/29035620/</a>   |                                  |                   |  |

| Author                      | Year Published  | Journal   | Type              |  |
|-----------------------------|---|---|-------------------|--|
| Priego-Quesada              | 2021  | International Journal of Environmental Research and Public Health | Preliminary Study |  |
| <b>Title</b>                | <i><a href="#">Reproducibility of Skin Temperature Response After Cold Stress Test Using the Game Ready System: Preliminary Study</a></i> |   |                   |  |
| <b>Publication Overview</b> | Study to investigate the reproducibility of lower limb skin temperature after a cold stress test using a CC device.                       |   |                   |  |
| <b>Summary Points</b>       | The cold stress test using a CC device showed a fair and good reproducibility, especially when the posterior leg region was assessed.     |   |                   |  |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/34444044/">https://pubmed.ncbi.nlm.nih.gov/34444044/</a>   |   |                   |  |


# SCIENCE

| Author                      | Year Published  | Journal  | Type             |  |
|-----------------------------|---|--|------------------|---|
| Wan                         | 2022  | Computational and Mathematical Methods in Medicine | Evaluation Study |   |
| <b>Title</b>                | <i><u>Evaluation of Application Effect of Self-Made Compression Cold Therapy in Postoperative Rehabilitation of Patients With Orthopedic Dyskinesia</u></i> |  |                  |   |
| <b>Publication Overview</b> | Study to investigate the application of self-made CC therapy in the rehabilitation of patients with orthopedic dyskinesia post-ankle fracture surgery.      |  |                  |   |
| <b>Summary Points</b>       | Many patients have post-procedure kinesiophobia due to pain. CC therapy can control refrigeration and reduce the possibility of tissue damage.              |  |                  |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/35898488/">https://pubmed.ncbi.nlm.nih.gov/35898488/</a>   |  |                  |   |




# **SAFETY & ADVERSE EVENTS**


# SAFETY & ADVERSE EVENTS


| Author                      | Year Published   | Journal                          | Type             |  |
|-----------------------------|--|----------------------------------|------------------|---|
| Jutte                       | 2022   | Journal of Sports Rehabilitation | Evaluation Study |   |
| <b>Title</b>                | <i><a href="#">Effects of 7 Consecutive Systematic Applications of Cryotherapy With Compression</a></i>  |                                  |                  |   |
| <b>Publication Overview</b> | Study to investigate the occurrence of frostbite and measure skin temperatures during the systematic application of 2 CC protocols.  |                                  |                  |   |
| <b>Summary Points</b>       | The application of 7 consecutive CC treatments did not result in any signs or symptoms of frostbite. These applications produced similar skin temperatures with each active cycle. |                                  |                  |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/35042184/">https://pubmed.ncbi.nlm.nih.gov/35042184/</a>  |                                  |                  |   |

# **REVIEW ARTICLES & CLINICAL EDUCATION**

# REVIEW & CLINICAL EDUCATION

| Author                      | Year Published  | Journal                       | Type                |  |
|-----------------------------|---|-------------------------------|---------------------|---|
| Hsu                         | 2019  | Journal of Orthopaedic Trauma | Clinical Guidelines |   |
| <b>Title</b>                | <i><a href="#">Clinical Practice Guidelines For Pain Management in Acute Musculoskeletal Injury</a></i>   |                               |                     |   |
| <b>Publication Overview</b> | Guideline to provide recommendations to improve the management of acute pain following musculoskeletal injury.  |                               |                     |   |
| <b>Summary Points</b>       | Balancing comfort and patient safety following acute musculoskeletal injury is possible when utilizing a true multimodal approach. Cryotherapy for acute musculoskeletal injury and the postsurgical orthopedic patient is conditionally recommended as an adjunct to other post-procedure pain treatments. |                               |                     |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/30681429/">https://pubmed.ncbi.nlm.nih.gov/30681429/</a>   |                               |                     |   |

| Author                      | Year Published   | Journal                   | Type   |  |
|-----------------------------|--|---------------------------|--------|---|
| Hoffman                     | 2021   | Holistic Nursing Practice | Review |   |
| <b>Title</b>                | <i><a href="#">"Everything Old Is New Again": A Review of Current Complementary and Alternative Medicine Trends</a></i>  |                           |        |   |
| <b>Publication Overview</b> | Study to review complementary and alternative medicine therapies that can be used as adjunct or preventative treatment methods to provide holistic care.   |                           |        |   |
| <b>Summary Points</b>       | Cryotherapy is indicated for pain relief in inflamed, injured, or overused muscles. It is often used in sports medicine for injury recovery and postseason recovery. Due to effects of decreased fatigue and stress, cryotherapy is also useful to promote overall wellness. |                           |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/34647911/">https://pubmed.ncbi.nlm.nih.gov/34647911/</a>  |                           |        |   |

| Author                      | Year Published  | Journal      | Type   |  |
|-----------------------------|---|--------------|--------|---|
| Kunkle                      | 2021  | JBJS Reviews | Review |   |
| <b>Title</b>                | <i><a href="#">Orthopaedic Application of Cryotherapy: A Comprehensive Review of the History, Basic Science, Methods, and Clinical Effectiveness</a></i>  |              |        |   |
| <b>Publication Overview</b> | Study to review the history, science, methods and clinical efficacy of cryotherapy in orthopedics.  |              |        |   |
| <b>Summary Points</b>       | Cryotherapy helps reduce the production of inflammatory mediators, local edema and nerve conduction velocity while disrupting the overall inflammatory response. Continuous cryotherapy devices demonstrated the best outcome in post-TKA patients with a significant reduction in pain, swelling and analgesic consumption while increasing ROM. |              |        |   |
| <b>Link to Manuscript</b>   | <a href="https://pubmed.ncbi.nlm.nih.gov/33512971/">https://pubmed.ncbi.nlm.nih.gov/33512971/</a>   |              |        |   |

