

ACL Rehabilitation

Cited References:

1. Raynor MC, Pietrobon R, Guller U, Higgins LD. Cryotherapy after ACL Reconstruction: A Meta-Analysis. *Journal of Knee Surgery*. 2005 Apr; 18(2): 123-9. Review.

ABSTRACT

Cryotherapy is a common treatment modality after orthopedic surgery procedures. Single institutional randomized clinical trials have evaluated the efficacy of cryotherapy after arthroscopically-assisted anterior cruciate ligament (ACL) reconstruction. Most of these studies were, however, underpowered to detect clinically relevant outcomes differences. This meta-analysis assessed the combined scientific evidence of studies evaluating the effectiveness of cryotherapy after arthroscopically-assisted ACL reconstruction. Electronic databases and bibliographic references of relevant articles were used to identify all relevant randomized clinical trials comparing cryotherapy to a placebo group after ACL reconstruction. Outcomes under investigation were postoperative drainage, range of motion, and pain. Random-effects models were used to combine the findings of the randomized controlled trials. Seven randomized clinical trials were included in the meta-analysis. Postoperative drainage ($P=.23$) and range of motion ($P=.25$) were not significantly different between cryotherapy and control group. However, cryotherapy was associated with significantly lower postoperative pain ($P=.02$). This meta-analysis showed that cryotherapy has a statistically significant benefit in postoperative pain control, while no improvement in postoperative range of motion or drainage was found. As the cryotherapy apparatus is fairly inexpensive, easy to use, has a high level of patient satisfaction, and is rarely associated with adverse events, we believe that cryotherapy is justified in the postoperative management of knee surgery.

2. Bjordal JM, Johnson MI, Ljunggreen AE. Transcutaneous Electrical Nerve Stimulation (TENS) Can Reduct Postoperative Analgesic Consumption. A Meta-Analysis with Assessment of Optimal Treatment Parameters for Postoperative Pain. *European Journal of Pain*. 2003; 7(2)L 181-8.

ABSTRACT

AIM: We investigated the literature of randomized placebo-controlled trials to find out if transcutaneous electrical nerve stimulation (TENS) or acupuncture-like transcutaneous electrical nerve stimulation (ALTENS) can reduce analgesic consumption after surgery. RESULTS: Subgroup analysis for adequate treatment (pulse frequency: 1-8Hz [ALTENS] or 25-150Hz [TENS], current intensity: "strong, definite, subnoxious, maximal tolerable" or above 15mA, and electrode

placement in the incision area) were performed. Twenty-one randomized, placebo-controlled trials with a total of 1350 patients were identified. For all trials, the mean reduction in analgesic consumption after TENS/ALTENS was 26.5% (range -6 to +51%) better than placebo. Eleven of the trials comprising 964 patients, had reports which stated that a strong, subnoxious electrical stimulation with adequate frequency was administered. They reported a mean weighted reduction in analgesic consumption of 35.5% (range 14-51%) better than placebo. In nine trials without explicit confirmation of sufficient current intensity and adequate frequency, the mean weighted analgesic consumption was 4.1% (range -10 to +29%) in favor of active treatment. The difference in analgesic consumption was significantly ($p=0.0002$) in favor of adequate stimulation. The median frequencies used in trials with optimal treatment was 85Hz for TENS and 2Hz in the only trial that investigated ALTENS. **CONCLUSION:** TENS, administered with a strong, subnoxious intensity at an adequate frequency in the wound area, can significantly reduce analgesic consumption for postoperative pain.

3. Rice D, McNair PJ, Dalbeth N. Effects of Cryotherapy on Arthrogenic Muscle Inhibition using an Experimental Model of Knee Swelling. *Arthritis & Rheumatology* 2009 Jan 15; 61(1):78-83.

ABSTRACT

OBJECTIVE: Arthrogenic muscle inhibition (AMI) contributes to quadriceps weakness and atrophy in knee arthritis and following joint injury. This laboratory-based study examined the efficacy of cryotherapy in reducing quadriceps AMI caused by intraarticular swelling. **METHODS:** Sixteen subjects without knee pathology participated, and were randomly assigned to a cryotherapy ($n = 8$) or control ($n = 8$) group. Surface electromyography (EMG) from vastus medialis and quadriceps torque measurements were recorded during maximum effort isometric contractions. All subjects then received an experimental joint infusion, whereby dextrose saline was injected into the knee to an intraarticular pressure of 50 mm Hg. EMG and torque measurements were repeated. Thereafter, the cryotherapy group had ice applied to the knee for 20 minutes while the control group did not receive an intervention. EMG and torque measurements were again collected. Quadriceps peak torque, muscle fiber conduction velocity (MFCV), and the root mean square (RMS) of EMG signals from vastus medialis were analyzed. **RESULTS:** Quadriceps peak torque, MFCV, and RMS decreased significantly following joint infusion ($P < \text{or} = 0.001$). Cryotherapy led to a significant increase in quadriceps torque and MFCV compared with controls ($P < 0.05$). The difference in RMS did not reach statistical significance ($P = 0.13$). **CONCLUSION:** The study demonstrated that cryotherapy is effective in reducing AMI induced by swelling. Cryotherapy may allow earlier and more effective quadriceps strengthening to occur in patients with knee joint pathology.

4. Fitzgerald GK, Piva SR, Irrgang JJ. A Modified Neuromuscular Electrical Stimulation Protocol for Quadriceps Strength Training Following Anterior Cruciate

Ligament Reconstruction. *Journal Orthopedic Sports Physical Therapy*. 2003 Sept; 33(9): 492-501.

ABSTRACT

STUDY DESIGN: Randomized clinical trial, single-masked. **OBJECTIVES:** To determine the effectiveness of using a modified neuromuscular electrical stimulation (NMES) training program as an adjunct treatment for improving quadriceps strength and physical function in rehabilitation following anterior cruciate ligament reconstruction (ACLR). **BACKGROUND:** NMES training for quadriceps strengthening has previously been shown to be an effective adjunct treatment following ACLR when performed against isometric resistance using a dynamometer with the knee positioned in flexion. We developed a modified version of published NMES protocol because some patients have difficulty tolerating the existing protocol and many clinics may not have instrumented dynamometers. There is a need to determine the effectiveness of this modified protocol. **METHODS AND MEASURES:** Forty-three subjects who had undergone ACLR were randomly assigned to either a group that received (NMES group) or did not receive (comparison group) the NMES treatment in conjunction with their rehabilitation. Group means for quadriceps strength and self-reported measures of knee function were compared after 12 and 16 weeks of rehabilitation. The proportion of subjects in each group achieving clinical criteria to initiate ambulation without crutches, treadmill running, and agility training at selected times during rehabilitation were also compared. **RESULTS:** The NMES group demonstrated moderately greater quadriceps strength at 12 weeks (effect size, 0.48), and moderately higher levels of self-reported knee function at both 12 (effect size, 0.72) and 16 (effect size, 0.65) weeks of rehabilitation compared to the comparison group. A greater proportion of subjects in the NMES group achieved clinical criteria for advancing to agility training at 16 weeks. **CONCLUSIONS:** The modified NMES quadriceps training protocol can be a useful adjunct to ACLR rehabilitation programs, but the treatment effect is smaller than what has been reported in previous studies.

5. Wright RW, Preston E, Fleming BC, Amendola A, Andrish JT, Bergfeld JA, Dunn WR, Kaeding C, Kuhn JE, Marx RG, McCarty EC, Parker RC, Spindler KP, Wolcott M, Wolf BR, Williams GN. A systematic review of anterior cruciate ligament reconstruction rehabilitation: part II: open versus closed kinetic chain exercises, neuromuscular electrical stimulation, accelerated rehabilitation, and miscellaneous topics. *Journal Knee Surgery*. 2008 Jul;21(3):225-34. Review.

ABSTRACT

Anterior cruciate ligament (ACL) reconstruction is a common surgical knee procedure that requires intensive postoperative rehabilitation by the patient. A variety of randomized controlled trials have investigated aspects of ACL reconstruction rehabilitation. A systematic review of English language level 1 and 2 studies identified 54 appropriate randomized controlled trials of ACL rehabilitation. This part of the article discusses open versus closed kinetic chain

exercises, neuromuscular electrical stimulation, accelerated rehabilitation, and miscellaneous topics.

6. Leetun DT, Ireland ML, Willson JD, Ballantyne BT, Davis IM. Core stability measures as risk factors for lower extremity injury in athletes. *Medicine & Science in Sports & Exercise*. 2004 Jun;36(6):926-34.

ABSTRACT

INTRODUCTION/PURPOSE: Decreased lumbo-pelvic (or core) stability has been suggested to contribute to the etiology of lower extremity injuries, particularly in females. This prospective study compares core stability measures between genders and between athletes who reported an injury during their season versus those who did not. Finally, we looked for one or a combination of these strength measures that could be used to identify athletes at risk for lower extremity injury. **METHODS:** Before their season, 80 female (mean age = 19.1 +/- 1.37 yr, mean weight 65.1 +/- 10.0 kg) and 60 male (mean age = 19.0 +/- 0.90 yr, mean weight 78.8 +/- 13.3 kg) intercollegiate basketball and track athletes were studied. Hip abduction and external rotation strength, abdominal muscle function, and back extensor and quadratus lumborum endurance was tested for each athlete. **RESULTS:** Males produced greater hip abduction (males = 32.6 +/- 7.3%BW, females = 29.2 +/- 6.1%BW), hip external rotation (males = 21.6 +/- 4.3%BW, females = 18.4 +/- 4.1%BW), and quadratus lumborum measures (males = 84.3 +/- 32.5 s, females = 58.9 +/- 26.0 s). Athletes who did not sustain an injury were significantly stronger in hip abduction (males = 31.6 +/- 7.1%BW, females = 28.6 +/- 5.5%BW) and external rotation (males = 20.6 +/- 4.2%BW, females = 17.9 +/- 4.4%BW). Logistic regression analysis revealed that hip external rotation strength was the only useful predictor of injury status (OR = 0.86, 95% CI = 0.77, 0.097). **CONCLUSION:** Core stability has an important role in injury prevention. Future study may reveal that differences in postural stability partially explain the gender bias among female athletes.

7. Ahmad CS, McCarthy M, Gomez JA, Shubin Stein BE. The moving patellar apprehension test for lateral patellar instability. *Am J Sports Med*. 2009 Apr;37(4):791-6. Epub 2009 Feb 3.

BACKGROUND: Physical examination maneuvers for patellar instability are often inaccurate. **HYPOTHESIS:** The "moving patellar apprehension test" is a sensitive and specific physical examination technique for the diagnosis of patellar instability. **STUDY DESIGN:** Cohort study (diagnosis); Level of evidence, 3. **METHODS:** The moving patellar apprehension test was performed in an office setting preoperatively and compared with the ability to dislocate the patella when examined under anesthesia in 51 patients. The examination begins with the knee held in full extension and the patella is manually translated laterally with the thumb. The knee is then flexed to 90 degrees and then brought back to full extension while the lateral force on the patella is maintained. For the second half

of the test, the knee is started in full extension, brought to 90 degrees of flexion, and then back to full extension while the index finger is used to translate the patella medially. For a positive test in part 1, the patient orally expresses apprehension and may activate his or her quadriceps in response to apprehension. In part 2, the patient experiences no apprehension and allows free flexion and extension of the knee. RESULTS: When compared with the ability to dislocate the patella under anesthesia, the moving patellar apprehension test was found to have a sensitivity of 100%, a specificity of 88.4%, a positive predictive value of 89.2%, a negative predictive value of 100%, and an accuracy of 94.1%. CONCLUSION: The moving patellar apprehension test is an accurate physical examination technique that, when performed and interpreted correctly, is highly sensitive and specific for patellar instability.