PERCEIVED MUSCLE SORENESS IS IMPROVED BY POST EXERCISE COMPRESSION GARMENTS: A CRITICALLY APPRAISED TOPIC

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CLINICAL SCENARIO

Muscle soreness is a recurrent complication among athletes of all activity levels. This issue can lead to reduced performance and lack of success on the field. One of the most common interventions used by clinicians to address this dilemma includes compression devices. The effects of compression devices on muscle soreness are currently unknown.

PURPOSE

The purpose of this research was to critically appraise the literature to determine the effects of compression garments on muscle soreness.

METHODS

Search Strategy

- Pubmed
- CINAHL
- PEDro Database
- SportDiscus
- Medline

Other resources found through review of reference lists and hand search

Inclusion and Exclusion Criteria

Inclusion
- Studies measuring muscle soreness by evaluating the values of creatine kinase in the athletes
- Studies with running or sprinting as the exhaustive exercise
- Level 3 or higher
- Studies done on humans only

Exclusion Criteria
- Studies limited to the last 10 years (2005-2015)
- Limited to the English language
- Athletes above the ages of 18

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RESULTS

The studies reviewed were identified as the “best” evidence and met the inclusion criteria (Table 1). None of the four articles meeting the inclusion criteria revealed significant improvements regarding muscle damage based on small effect sizes from all articles.1,2,9,15 However, there were significant improvements in perceived muscle soreness for subjects wearing compression garments.

DISCUSSION AND CONCLUSIONS

Our study involved the evaluation of high quality evidence to determine the effectiveness of compression garments as a recovery tool following participation in sports where running is involved. The main hypothesis was that the athletes would experience a reduction in muscle soreness with the use of a compression garment after exhaustive exercise. While the evidence does not support the idea that compression garments positively impact physiologic markers associated with muscle soreness, the evidence does support significant reductions in muscle perceived soreness.

The studies that were reviewed displayed significant outcomes for perceived muscle soreness reduction. The results show evidence that indicated running athletes believed they were not as sore when wearing the compression garments 24 hours after workouts. Outcomes of these studies are important because it establishes that running athletes perceive less soreness after applying compression garments rather than generating a physiologic reduction in muscle soreness. Interestingly, there was no significant change in performance measures in the experimental groups as compared to the control groups in three of the studies evaluated.

Furthermore, the garments did not have an effect on the blood markers for muscle damage, including creatine kinase levels.1,2,9,15 Every participant had a 10 mm hemorrage which was measured for all of the studies utilized wearing compression garments. When all of the studies utilized sprinting or running to exhaustion, each investigation chose elite athletes from different levels. In two of the studies,1,2 participants consisted of rugby players; another study6 included cricket players; the final study7 utilized marathon runners. Ultimately, similar results for soreness were documented for the contact and non-contact sports.

REFERENCES

Exercise Induced Asthma (EIA) is prevalent throughout all levels of sport and if not properly identified can be fatal. There is no standard protocol for preventative warmups for athletes with EIA. Proper warmups can help to reduce the incidence of an exercised induced bronchospasam (EIB). Current position statements for preventative warmups in athletes with EIA expose a slow, progression of activity to optimize preventative benefits. However, consensus in the literature upon which level of warmup intensity is the most effective in preventing an EIB remains elusive.

**PURPOSE**

The purpose of this critically appraised topic (CAT) was to determine if performing high intensity interval warmups versus continuous moderate intensity warmups before activity reduce the incidence rate and severity of an asthma attack in athletes.

**METHODS**

- **Search Strategy**
  - Terms Used in Search Strategy (PICOS)
    - **Patient:** athletes with exercise induced asthma
    - **Intervention:** warm up OR preparation
    - **Comparison:** none
    - **Outcomes:** reduce chance of EIB during activity
  - **Sources of Evidence Searched**
    - PubMed
    - Cochrane
    - PEDro
    - ProQuest
    - Hand Search through previously reviewed literature for topic on question

**Inclusion and Exclusion Criteria**

Studies that were included examined differences in warm up procedure in athletes with EIA, were of a level 2 evidence or higher, or the English language, and limited to humans. Articles excluded were those that focused on pharmacological differences in EIA prevention.

**RESULTS**

Four relevant studies, 1,2,3,4 were located and one study was found but not included because it focused on the pharmacological differences in EIB prevention. The following studies were identified as the "best" evidence and selected for inclusion in the CAT (Table 1). The reasons for selecting these studies were because they examined the effects of different warmup procedures in athletes with EIA and they were graded with at least a level 2 evidence or higher.

**DISCUSSION AND CONCLUSIONS**

Our purpose for this critically appraised topic was to determine a proper warmup procedure for athletes with EIA. We believe that a high intensity warmup would be most effective at reducing incidence and severity of an EIB. All four of our studies included a decrease in the incidence rate and severity of EIB in athletes with EIA. Bishop et al. 2004 showed that participants who completed a long run and experienced a decrease in breathing capacity were more likely to experience a bronchoconstriction versus participants that completed an interval warmup. McKenzie et al. 1994 showed that those who performed a high intensity interval warmup experienced a period of bronchodilation thus allowing for greater changes in expiratory flow rates. Mickleborough et al. 2007 determined that high intensity interval warmups improve pulmonary function to decrease the stress on the athletes’ lungs from exercise. Schnall et al. 1998 concluded that short runs caused bronchodilation to aid in prevention of an EIB and further stressed the importance of a warmup protocol for athletes. In athletics, EIA is generally ignored until an athlete begins experiencing an EIB. Instead of being proactive, athletic trainers and coaches instead deal with EIB once it presents itself. Previously, it was unknown how to effectively prevent athletes from experiencing EIB. The National Athletic Trainers Association6 suggests the use of a warmup protocol to reduce the incidence of EIB without further explanation on the type of warmup to use.

Also, the article explains in detail the procedure for how to treat an athlete experiencing an EIB but it does not go into detail on how to prevent these EIBs from occurring.7 This reflects the general attitude toward athletes with EIA such that they are often overlooked until the detrimental effects are obvious. Athletic trainers need to educate themselves on the proper procedures for aiding in the prevention of EIB. Another problem is that the line of communication between coaching staff and medical staff has not been opened in order to create an understanding for the importance of a proper warmup technique for athletes with EIA. Therefore, clinicians need to relay this information to the coaches because the warmup procedures are generally the responsibility of the coaches. Current and common warmup procedures consist of moderate intensity for extended periods of time. As found in the studies, this type of warmup is not effective in preventing EIB. After reviewing the findings, it can be concluded that a high-intensity warmup is needed to aid in prevention of an EIB. To summarize the type of high-intensity warmups used, we suggest completing five to ten 30-second sprints with one to two minutes rest in between sprints, depending on how the athlete responds. The athletes can complete one or two sets with a recommended 5-minute break in between sets. If coaches prefer athletes to participate in a group warm-up, the asthmatic athletes should complete this high-intensity warmup prior to the group warm-up. It is imperative to aid asthmatic athletes in preventing the occurrence of EIB and one way to accomplish this is to complete type of high intensity warmup regardless of activity of the athlete will engage.

**REFERENCES**

INTERVAL CRYOTHERAPY HAS A POSITIVE EFFECT ON OVERHEAD KINETIC ACTIVITIES IN ADULT MALES: A CRITICALLY APPRAISED TOPIC

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PURPOSE
To determine the effect of interval cryotherapy on overhead kinetic activity in adult males.

METHODS

Search Strategy
Terms Used to Guide Search Strategy (PICO)
- Patient/Client group: adult males
- Intervention (or Assessment): cryotherapy OR cold therapy OR ice
- Comparison: no intervention
- Outcome: performance OR velocity

Sources of Evidence Searched
- PubMed
- The Cochrane Library
- Sport Discus
- CINAHL
- Additional resources obtained via review of reference lists and hand search

Inclusion and Exclusion Criteria
Inclusion
- Studies investigating cryotherapy on shoulder joint to measure performance
- Level 1 evidence
- Limited to English language
- Limited to humans
- Limited to the last 15 years (2003-2013)

Exclusion
- Injuries to the shoulder
- Physical health, arm, or shoulder problems that could influence the results of performance

RESULTS

Three relevant studies were located and categorized in Table 1 (based upon Centre of Evidence-Based Medicine). Two of the studies1,2 demonstrated the effects of interval cryotherapy in baseball pitching. The third study3 demonstrated the effect of interval cryotherapy in weight lifting.

DISCUSSION AND CONCLUSIONS

The main purpose of this study was to determine the effect of interval cryotherapy on overhead kinetic activity in adult males. The study had significant results supporting the effects of cryotherapy when applying ice to the shoulder intermittently. The outcomes of these studies suggest that interval cryotherapy has a positive effect on performance.

Cryotherapy is a cold application that results in conductive heat loss and reduces muscle temperature. The duration of intermittent cooling of the shoulder decreases tissue temperature, but does not penetrate deep enough to affect muscular functioning. The use of interval cryotherapy has been shown to benefit in repeated performance.1 In the second Verducci study it states, baseball pitchers typically use cold therapy after activity to decrease recovery time.2 Clinicians can implement the use of interval cryotherapy in the treatment of overhead athletes involved in kinetic activity who wish to increase their performance. Performance is affected by velocity, accuracy, work, power, and soreness. The shoulder joint is subjected to high stress as a result of repetitive overhead activities,1 causing a decrease in performance.

All three studies had a common variable of velocity, which increased after intermittent cryotherapy. Intermittent cryotherapy showed an overall increase in performance.

Due to the lack of research of interval cryotherapy on specifically throwing performance, the third article replicated a baseball study2 to determine if similar results would be achieved by increasing the weight of a baseball to seventy five percent of the one-repetition maximum arm pull. Similar results were obtained, increasing work, velocity, and power when using interval cryotherapy between weight-pulling sets. Therefore, interval cryotherapy can be applied to increase performance in other upper body sports specific activities.

REFERENCES

Future research should investigate the effect on recurrent trials of intermittent cooling by manipulating various shoulder motions. Future investigation should also explore how temperature influences muscle fatigue. In addition, further research containing overhead athletes in other sports can be utilized to examine the effect of interval cryotherapy.

Table 1 - Characteristics of Included Studies

| Study | Participants | Interventions | Outcomes Measures | Main Findings | Level of Evidence/Validity
|-------|--------------|---------------|-------------------|---------------|-------------------------|
| Bishop et al. (2013) | Eight trained amateur male baseball pitchers with no previous history of elbow or shoulder injury were recruited and participated in this study (n=8). | Interventions: Three fastball at a target of one pitch every 30 seconds. 12 pitches per inning with 6 minutes of rest in between, 3 volumes. First trial was to adapt to the protocol, followed by two game trials. | Velocity, differences in treatment, and subjective ratings | Shoulder and forearm cooling between innings had an increase in pitching velocity when using interval cryotherapy. | Level 1 evidence
| Verducci (2001) | Ten male volunteers of a physical education class (age = 29.0 ± 2.8 years). | Interference cryotherapy (CT) treatment consisted of applying 6 ice bags (2 x 2.5 inches) for 3 minutes after every third inning. | Innings pitched, pitch velocity, arm and shoulder soreness | Interventions consisting of using ice bags between innings significantly increased velocity. | Level 1 evidence
| Verducci (2000) | Six university NCAA Division 1 level non-scholarship baseball pitchers (age = 22.3 years, height = 170.2 cm, body mass = 84.4 kg, M weight = 84.4 kg, SD = 0.8 kg, M experience pitching = 13.5 years, SD = 1.2, and all total years pitching baseball = 15.5 years, SD = 2.07) participated in this study. | Interval cryotherapy (CT) treatment consisted of applying 1 plastic bag (2 x 2 inches) for 3 minutes after every third inning. | Interventions consisted of using ice bags between innings significantly increased velocity. | Level 1 evidence

Three minutes of interval cryotherapy between innings significantly delayed recovery and reduced subjective exertion. Due to the lack of research of interval cryotherapy on specifically throwing performance, the third study replicated a baseball study to determine if similar results would be achieved by increasing the weight of a baseball to seventy five percent of the one-repetition maximum arm pull. Similar results were obtained, increasing work, velocity, and power when using interval cryotherapy between weight-pulling sets. Therefore, interval cryotherapy can be applied to increase performance in other upper body sports specific activities.