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IN THIS ISSUE

- Hydrotherapy Based Recovery
- Mental Pictures & Training
- High Jump & Weight Training
- Javelin Analysis
- Interview with Bronwyn Thompson
- Gary Bourne – Coach Profile

Stretching During Warm Up

How 'Tight' is the Evidence? *Sean Horan and Benjamin Weeks*



INTRODUCTION

Traditionally, stretching has been practiced as a means of preparing the body for activity. A variety of stretching methods and techniques have been advocated for eliciting improvements in flexibility and performance in addition to reducing injury risk during training and competition. Although the scientific literature surrounding the effects of stretching is quite meagre, there have been an increasing number of reports in recent years.

The following article will consider current knowledge of the effects of stretching in light of its importance in the warm up. Specifically, we will consider the efficacy of stretching regimes in the context of flexibility, performance, and injury prevention. Simple, practical key points will be illuminated for the coach.

STRETCHING FOR FLEXIBILITY

The intuitive effects of a stretching regime would almost certainly include improved flexibility. A number of studies have reported improvements in joint range of motion (ROM) following the instigation of various regimes of stretching (Sady et al., 1982; Chan et al., 2001; Mahieu et al., 2007). The most commonly practiced forms of stretching include static, ballistic, and proprioceptive neuromuscular facilitation (PNF).

Static stretching typically involves the application of a sustained force to a particular muscle or joint for an extended period of time. In practice, the duration of a stretch varies considerably among different sporting populations and individuals, however, 30-60 seconds has been recommended (Bandy et al., 1997; Chan et al., 2001). Static stretches are held in a stationary position such that a feeling of tension rather than pain should be achieved. With time the muscles relax, which subsequently allows the limb to be stretched further. It has been suggested that static stretching is the safest method of all stretching types, as it produces the least amount of tension over a prolonged duration (Brukner and Khan, 2001). The role of static stretching in increasing flexibility or joint ROM is well supported among the literature, with several groups reporting improvements following static stretching regimes (Bandy et al., 1997; Chan et al., 2001; Power et al., 2004).

Ballistic stretching, however, is held for a much shorter duration, and involves stretching to a point near the limits of normal ROM. Typically, ballistic stretching is associated with short, sharp, bobbing, and bouncing type movements (Alter,

1996). Safety is often a concern with ballistic stretching, as it generally induces a strong reflex muscle contraction. Stretching a muscle while it is simultaneously contracting is thought to increase the risk of muscle injury, however, this is yet to be substantiated with empirical evidence. Hence, ballistic stretching is not as widely used, despite prospects of an important role in sports where maximal joint ROM is beneficial (e.g. gymnastics and martial arts). As for static stretching, there is evidence from the athletic population that ballistic stretching is associated with improved flexibility (Sady et al., 1982; Lucas and Koslow, 1984; Mahieu et al., 2007). Whether or not ballistic stretching is more beneficial than static stretching in improving flexibility is still debatable.

Proprioceptive neuromuscular facilitation (PNF) stretching is a technique that involves contraction and relaxation of antagonistic (i.e. opposing) muscle pairs whilst a partner applies a passive stretch. The contractions can be concentric, eccentric, or isometric and are normally followed by a passive stretch (Alter, 1996). The premise being that the muscle will be in a more relaxed state, thereby providing less active resistance to the applied stretch. PNF stretching in several cases has been found to improve ROM more effectively than other methods such as static and ballistic stretching (Sady et al., 1982; Lucas and Koslow, 1984; Perez and Fumasoli, 1984). Care must be taken when applying PNF stretches to avoid 'overstretching' as the athlete does not have complete control of the stretch.

Therefore, it appears that most forms of stretching will lead to benefits of flexibility. Perhaps, most important to the coach when choosing an appropriate and effective stretching regime is consideration of sport-specific flexibility and the risk of injury to the athlete.

Key Points: Stretching for Flexibility

- **Most stretching regimes lead to increased flexibility**
- **When deciding on the appropriate type of stretching one should consider injury risk and sport-specificity**

STRETCHING FOR PERFORMANCE

Stretching is traditionally considered a method of preparing

the body for activity; however, its affect on performance has not been a strong research focus until recent years. It is necessary to question the dogma of “stretch before you play” to confirm its efficacy. The primary mechanical function of muscle is to exert forces on bones (the levers of the body) via contraction, thereby producing movement. As such, investigating the effect of stretching on parameters of muscle force is warranted. Results to date have been less than attractive.

In terms of acute stretching prior to activity, most studies have reported detrimental effects on muscle strength (Rubini et al., 2007). For instance, Marek and colleagues observed reduced muscle strength and power following either static or PNF stretching in young, healthy adults. Cramer (2005) conducted an electromyography (EMG) investigation of acute static quadriceps stretching and reported similar reductions in force production and muscle activation. In a later study by the same group (Cramer et al., 2007), there was insufficient evidence to suggest a positive effect of static stretching on knee extensor strength and power. Thus, it appears static stretching prior to activity may reduce muscle strength parameters or have little effect at best.

Despite a clear lack of research, chronic stretching may produce more desirable effects on performance. Kokkonen and colleagues (2007) recently reported the results of a static stretching regime (10 wk, 3 days.wk⁻¹, 40 min) in 38 healthy adults. Those in the stretching group improved in a number of performance measures, including flexibility (18%), standing long jump (2%), vertical jump (6%), 20-m sprint (1%), knee flexion and extension strength (15% and 32% respectively), and knee flexion and knee extension endurance (30% and 28% respectively). Those in the control group did not improve performance for any measure. Although these initial findings are positive, continued investigation of the effects of chronic stretching on performance is necessary to allow for practical recommendations.

Thus, it appears that the acute effects of stretching are rather meagre, while chronic stretching may improve performance measures, such as strength, power, and speed. Stretching might also be useful as an adjunctive training modality to target such outcomes, or even as an alternative when environmental conditions or injuries prevent participation in more traditional training methods.

Key Points: Stretching for Performance

- Considerable stretching immediately prior to activity may reduce performance
- Improved strength and power may be achieved with a chronic stretching regime

STRETCHING FOR INJURY PREVENTION

The use of stretching as an injury prevention measure has been widely accepted and promoted among the sporting and athletic communities. However on closer inspection there is a distinct lack of conclusive, recent, scientific evidence that supports this notion. Stretching often forms a major part of the pre-exercise warm up and in some cases may be the only element involved. It is pertinent, however, that we question its application in the prevention of injuries. Firstly, we need to consider the compliance of the muscle-tendon unit we are stretching.

The two main components of a muscle are the active component (contractile muscle tissue) and the passive component (connective tissue, i.e. tendon) (Weldon and Hill, 2003). Both components deform or elongate during stretching, but it has been suggested that it is the active component that is more commonly injured. During the eccentric phase of a given manoeuvre the muscle-tendon unit lengthens while the active component contracts to facilitate energy absorption and decelerate the body. In this fashion, muscle strains tend to transpire during the eccentric phase of an activity, whereby the active component fails during a ‘lengthening contraction’ (Noonan and Garrett Jr, 1992).

In the case of an athlete with a muscle-tendon unit that is inflexible, however, forces will be transferred to the active component, which may lead to subsequent muscle injury. With this in mind, an increase in passive compliance associated with long-term application of stretching could theoretically lower the risk of muscle strain injuries.

A number of studies have investigated the relationship between stretching and injury rates, however all have produced inconclusive findings (Bixler and Jones, 1992; Van Mechelen, Hlobil et al., 1993; Pope, Herbert et al., 2000). Even systematic reviews that have attempted to consolidated the stretching literature have concluded that the efficacy of stretching as an injury prevention measure cannot be supported with current evidence (Weldon and Hill, 2003; Witvrouw, Mahieu et al., 2004).

Key Points: Stretching for Injury Prevention

- Stretching immediately prior to activity may not affect injury risk, however;
- The cumulative effects of a regular stretching program may lead to improved flexibility that may reduce injury risk

CONCLUSION

In summary, coaches should critically evaluate the stretching practices of their athletes to ensure their efforts are worthwhile. Just as training methods must be specific to the physical demands of the event, stretching should also be contextualised rather than simply being 'attached' to a training session. It may be that stretching immediately prior to activity has little impact on injury risk and a potentially negative impact on performance, however, routines that improve flexibility over time, whether undertaken during a warm up or otherwise, may indirectly exert their influence on injury risk and performance.

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