CHIROPRACTIC PERFORMANCE & SPORTS THERAPY CENTRE

CURRENT CONCEPTS IN STRETCHING

Portions of this article are adapted from "Does Stretching Help Prevent Injuries" by Dr. Ian Shrier © 2002.

INTRODUCTION

Over the past 30 years, sport health care professionals have promoted stretching as a way to decrease the risk of injury 1-6. Two potential mechanisms are often proposed by which stretching could decrease injury:

- A direct decrease in muscle stiffness by way of changes in elastic properties,
- Or an indirect decrease in muscle stiffness via "reflex muscle inhibition" (stretching of one muscle causing its opposite muscle to relax) and consequent changes in elastic properties.

These changes in muscle stiffness would allow for an increased range of motion (ROM) around a joint (i.e. "flexibility"), which is believed to decrease the risk of injury. Despite these claims, new research has challenged some of these concepts. Additionally, stretching immediately before exercise may have different effects than stretching at other times.

IMMEDIATE EFFECTS

- Stretching is believed to increase the range of motion around a joint through decreases in viscosity (stiffness) and increases in compliance of muscle.
- Stretching appears to affect the visco-elastic behaviour of muscle and tendon, but the duration of the effect appears short. Certainly less than 30 minutes.

As one observes the people around them, it becomes clear that some people are naturally flexible even though they never stretch, whereas others remain inflexible no matter what they do. The effect of stretching also appears to be individual specific and muscle specific. For instance, within every study, some individuals have large increases in range of motion with stretching whereas others do not, both in animal [8] and human studies [11, 12]. In addition, stretching appears less effective in increasing hip external rotation and abduction compared to hip flexion [13]. If true, the optimal duration and frequency for stretching may be different for different muscle groups. This appears logical given that different muscles have different temperatures (superficial muscles are colder than deep muscles) and different angles of pull. More research is needed on which variables are responsible (and to what degree) for the variation observed in response to stretching protocols.

- Stretching also appears to increase the pain threshold during a muscle stretch, i.e. it acts like a pain reliever [14-16].

- Finally, the analgesia is at least partially due to the effects at the spinal cord or higher brain level, evidenced by the fact that during *one-sided proprio-neuro-facilatory (PNF) stretching, the range of motion in the non-stretched leg also increases.*

PNF stretching is also an interesting example of how myths can be propagated within the medical literature. When it was first proposed in the early 1970's, PNF techniques were based upon the basic science finding that stretching / activity of a muscle on one side creates reciprocal inhibition of it's opposite muscle group[17]. When tested, PNF techniques were indeed shown to increase ROM more than static stretching. However, these initial studies did not measure muscle activity so the reason for the increased ROM was not known. In fact, when EMG (electromyography) was recorded in 1979, the reciprocal inhibition theory was disproved [18]. Although these results have [19]been confirmed more recently [15,20], the myth of reciprocal inhibition continues to be promoted in textbooks and the medical literature. In fact, muscles are electrically silent during normal stretches until the end range of motion is neared. Surprisingly, PNF techniques actually increase the electrical activity of the muscle during the stretch [18-20], even though the range of motion is increased [15,18,21].
This suggests that:

1) PNF stretching is associated with a more pronounced analgesic effect and

2) The muscle is actually undergoing an *eccentric contraction* during a "PNF stretch". Eccentric contraction is when a muscle is contracting while it is being stretched.

LONG-TERM EFFECTS

Although the immediate effects of a single stretching session produce a decrease in visco-elasticity and an increase in stretch tolerance, the effect of stretching over 3-4 weeks appears to affect only stretch tolerance with no change in visco-elasticity [21,29]. In this case, a second explanation for the increased stretch tolerance besides an analgesic effect is possible; *regular stretching may induce muscle hypertrophy (stretching may help to strengthen the muscle).*

Does stretching immediately before exercise prevent injury?

SUMMARY OF CLINICAL EVIDENCE

Overall, the only studies to suggest that pre-exercise stretching might prevent injuries included a warm-up program as a co-intervention. All other studies suggested that pre-exercise stretching has no benefit or may be detrimental. ***Thus, the clinical evidence available does not support the hypothesis that pre-exercise stretching prevents injury*****.** Furthermore, many suggest stretching as a pre-cursor to exercise as a way to enhance performance. Recent studies in middle distance varsity running show that stretching prior to competition actually decreases performance. Although the exact mechanism is not fully understood, many theorize that stretching increases the athlete's range of motion more than what is required to perform the activity resulting in the body requiring more energy to stabilize itself. Thus the athlete has less available energy stores for propulsion to perform the necessary sport skills.

Discussion

A review of the clinical evidence strongly suggests that pre-exercise stretching does not prevent injury, may impede performance and that the evidence on stretching at other times is too limited to make any realistic recommendations. Some people believe injuries occur when the muscle is stretched beyond its normal length. Although this can occur in some situations, most authors believe an injury occurs when the muscle cannot absorb the force applied to it and that *the most important variable with respect to muscle injury is the energy absorbed by the muscle.*

We have seen that the increased range of motion with stretching is partly due to an analgesic effect [15,16,18,21]. This explains why stretching may provide short-term relief for muscle aches and pains but does not mean that the risk of injury is decreased. Nor does it mean that stretching shortens rehabilitation time and prevents re-injury following an injury. The reader should remember that stretching at times other than before exercise may theoretically induce hypertrophy (increased muscle strength and size) [30-32], and if future evidence suggests this occurs, an increase in strength is likely to decrease injuries.

Stretching may still prove beneficial, but not for the reasons that everyone originally thought!

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