DYNAMIC WARM UP: THE ONLY PRE TRAINING AND PRE MATCH ROUTINE

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ABSTRACT

Individual and Team Sport warm ups have been a contentious issue for coaches and players alike for many a season. This paper examines the role of dynamic movement patterns prior to performance and its impact on performance. It is well known that the primary role of any warm up is to contribute to a player’s “readiness to perform”. The warm up also has a major role in injury prevention. In this paper, researched articles and discussion with elite coaches and athletes coupled with elite sporting teams will reiterate the important role that the dynamic warm up has to play in both amateur and professional sport. As will be discussed the Dynamic warm up not only allows players to perform at an optimal level but also decreases the risk of soft tissue injuries.

INTRODUCTION

The warm up is the introductory part of any training session or competitive event. A sound warm up procedure prepares your athletes physiologically and psychologically for training or competition (11). Many coaches and trainers working with athletes today still approach the pre competition warm up in the traditional manner of general running and calisthenics followed by stretching. This approach initially emphasizes activities using gross motor patterns that have been proven to enhance performance. In addition to the traditional warm up, however, certain new approaches may further improve performance (23).

The physiological benefits of the warm up are: increase in body temperature prevents injury to dynamic and static stabilizers, increase blood flow to muscles, delivers more oxygen to the muscle cells, increases nerve conduction velocity and promotes more efficient cellular metabolism. A warm up also provides psychological benefits. Even the most experienced athletes exhibit signs of anxiety and tension prior to competition (23). A pre competition warm up in the form of a light workout session decreases stress and anxiety and helps the athlete focus on the upcoming task (10).

Stretching is often incorrectly considered synonymous with the warm up because it is commonly done during the warm up portion of a training program. In addition, static and passive stretching exercises do virtually nothing to increase core or peripheral temperatures and blood flow; hence, these stretching techniques do not serve as a warm up (1).

The intensity and duration of a warm up must be suited to the athlete’s physical capabilities and adjusted to the existing conditions. Generally, an athlete’s warm up should be intense enough to increase body temperature and cause some sweating but not so intense as to cause fatigue (1).
The following table outlines the main types of stretches available to the individual or team.

**Table 1 - Types of stretches and definitions (6).**

<table>
<thead>
<tr>
<th>Type of Stretch</th>
<th>Definition</th>
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<tr>
<td>Ballistic stretch</td>
<td>Muscles are stretched by the force of momentum of a body part that is bounced, swung or jerked.</td>
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<tr>
<td>Dynamic stretch</td>
<td>Moving parts of your body and gradually increasing reach, speed of movement, or both.</td>
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<tr>
<td>Passive stretch</td>
<td>Stretch imposed on a muscle by a force other than the opposing muscle, for example by another person.</td>
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<tr>
<td>Proprioceptive Neuromuscular Facilitation</td>
<td>Special exercise techniques to increase the contraction or the relaxation of muscles through reflex mechanisms.</td>
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<tr>
<td>Static Stretch</td>
<td>A muscle is slowly stretched and then held in that stretched position for several seconds.</td>
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Warm up routines are typically classified into three categories. A passive warm up involves raising the body temperature by some external means such as heating pads and hot showers. General warm up is probably the most commonly used technique. It employs various movements not directly related to those employed in the activity itself. These include joint rotations and gentle twisting and bending movements. This is usually followed by light calisthenics, brisk walking, jogging or jumping rope. Here the goal is to increase blood flow and raise body temperature. A formal or specific warm up includes movements that mimic or are employed in the actual event, yet are performed at a reduced level of intensity (1).

The purpose of this paper is to examine which warm up procedure, static or dynamic stretching, is more beneficial to the individual to achieve maximal sporting performance. Dynamic stretching according to Kurz (14), “involves moving parts of your body and gradually increasing reach, speed of movement or both”. Dynamic stretching should not be confused with ballistic stretching. Dynamic stretching consists of controlled leg and arm swings that take you (gently) to the limits of your range of motion. Ballistic stretches involve trying to force a part of the body beyond its range of motion. In dynamic stretches, there are no bounces or jerky movements. Static stretching could be described as stretching a muscle to its farthest point and then maintaining or holding that position. Training and competition warm ups from other sports such as Australian Rules, Olympic track and field athletes, Rugby Union and Cricket will be examined throughout this paper. While there is a need to isolate some muscles and joints which have been identified for special attention, relatively little regard has been given to the development of functional or dynamic stretching techniques which prepare the athlete for sport specific action (4).
LITERATURE REVIEW

In the 1950's when the benefits of pre activity warm up were still uncertain, a number of controlled studies were done to assess the influence of warm up on performance. Activities such as vertical jump, swimming, throwing and running were examined. Pacheco and Richards (17) studied the effects of warm up on vertical jump performance and found that the proper amount of warm up increased performance. De Vries (7) examined the effects of various warm up procedures (hot showers, calisthenics, massage and swimming versus no warm up) on 100 yard times of competitive swimmers and found that only calisthenics and swimming showed any significant improvement on 100 yard times. De Vries (7) also found that an improper warm up had negative effects on swim times. Studies on pre exercise have examined not only cause/effect relationship between performance and warm up but also the psychological effects of a warm up prior to a sports event (24).

Flexibility like strength or endurance, is a functional component of movement but too often it has been isolated from its functional role and even been seen in opposition to other capacities. Rarely do practitioners take a broader view and look at functional flexibility as a component of movement in their sport. For the last twenty years research and training about flexibility has been largely the preserve of the sport medicine fraternity which has conducted very effective educational programs (4). These have included promoting concepts indicating that “failure to stretch (static stretching) particularly before training increases the chances of being injured”. In Australia this view has had a major impact on training programs, both in terms of how coaches and athletes perceive flexibility and how and when they use stretching techniques eg. The mass inclusion of static stretching in warm ups (4).

Does stretching prevent injury? The strongest support for this hypothesis, that stretching reduces injury risk, comes from prospective cohort studies (8). While cohort studies provide useful prognostic information about injury risk, they do not provide strong evidence of a causal relationship between stretching and injury risk. Until recently there had been no published randomized trials examining the prophylactic effect of stretching. In 1998, two large scale randomized trials were undertaken in Australia to determine if conventional stretching programs reduce injury risk in an at risk population (18).

The first study involved 1093 male recruits, and the second 1538. All subjects were undertaking 12 weeks of intense military training. Recruits were randomly allocated to stretch (static stretch) or control (no stretch) groups. Pre and Post screening for injuries and flexibility assessment were conducted for both studies. All injuries were recorded during the 12 week period. Results showed no significant effect of pre exercise stretching on injuries sustained. However, fitness was a strong predictor of injury risk; with the least fit subjects being 14 times more likely to sustain injury than the fittest subjects. The authors concluded that, “a typical muscle stretching protocol performed during pre-exercise warm up does not produce clinically meaningful reductions in risk of exercise related injury” (18).

Interestingly, a similar American study also using military trainees (13) has provided supportive evidence. Subjects were divided into control and intervention groups with both groups performing the same static stretches before training. The intervention (experimental) group performed static stretches before lunch, dinner and bedtime i.e. static stretches were also performed after exercising. Results showed that static stretches prior to exercise did not prevent lower extremity overuse injuries, but additional static stretches after training and bed resulted in 50% fewer injuries occurring (4). In 1989 static stretching was removed from warm up drills for the soccer squad at the Australian Institute of sport with active movements and specific foot and bodywork drills used during the warm up instead. Until that time stretching had not been undertaken in the warm down so static stretches were included in warm down activities post training and post-game three times a week. Training injury rates fell significantly (calves, shins, hamstrings, groins) and hip flexibility measuring extension and flexion, improved by an average of 20 degrees over a four month period (5).

Flexibility is a critical component for movement but with reduced functional flexibility the efficiency of movement is compromised and this compromise increases the risk of mechanically induced injuries. The argument that stretching prevents injury is a misrepresentation and an over simplification of the logic underlying the relationship of flexibility for movement efficiency, and the fact that inefficient movements are a major contributor to training injuries, not flexibility per say (4).
Another assumption underlying this myth is that static stretching is the technique by which appropriate flexibility is achieved. While static stretching can increase passive flexibility there is little research to demonstrate its correlation with the dynamic flexibility required in sporting actions. In addition the idea that static stretching in the warm up will prepare muscles for action is fallacious (4).

When a passive muscle is stretched it does not behave like a simple elastic structure (19). A few cross bridges between actin and myosin are still present even after apparent muscle relaxation following contraction. This results in an initial stiffness when a static stretch is applied. The presence of these cross bridges and the resultant stiffness in these muscle fibres produces a degree of slack, the tension response to stretch shows a delayed rise as movement takes up the slack. In coaching terms this means that the contraction rate of muscles following static stretching is slower. Is this appropriate for preparing the muscle before training? (4). Research by physiotherapists at the Australian Institute of Sport has compared the effect of static and ballistic stretching on hamstring strength. Results indicated that static stretching produced a significant reduction in eccentric hamstring strength of the order of 7% whereas the concentric strength was unaffected by either static or ballistic stretching (20). The authors concluded that prolonged static stretching has the propensity to depress strength in the immediate post stretch period.

Alter (1) has argued for the inclusion of ballistic stretching in training because the dynamic demands placed on the muscle are similar to sporting demands. This is despite the debates about whether it is potentially dangerous because it may evoke the stretch reflex.

At an International coaching school post Commonwealth Games in Canada (1995) it was stated by Dr Istvan Balyi, “warm up is not a flexibility exercise”, he went on to say that “static stretching should never be undertaken before a competition, as static stretching sends a message to the muscle to relax”. There is changing ideas of the value of stretching muscles. Ballistic stretching, providing it is light, is gaining popularity as part of a warm up. PNF stretching is not recommended before major competitions. However, full static stretching could be undertaken as a special session rather than be included in the warm up (2).

A study undertaken by Seagrave (21) showed that a dynamic warm up produced a twenty two percent increase in power output when performing a series of dynamic activities. The study compared the athlete’s performance after undertaking a static stretch prior to performing a series of tests such as standing long jump, standing triple jump, vertical jump, 30m sprint, medicine ball throw. They also completed a dynamic warm up at a later date and performed the same tests. This exercise was done seven times over a period of 4 weeks and the results indicated, performances were greatly increased after a dynamic warm up. Athletes also reported a state of “readiness to perform” after completing the dynamic style warm up. They also stated they felt “flat” and “too relaxed” to perform at their optimum when undertaking the static stretch.

**ELITE TEAMS AND ELITE INDIVIDUAL ATHLETE WARM UPS**

If we consider contemporary professional sporting teams and their warm ups, we see a definite consistency in the movement towards dynamic warm ups. Loren Seagrave, a world renowned high performance coach in the United States and Performance Director of Velocity Sports is a leading advocate for dynamic warm ups. In his warm ups with his athletes, the warm up is specifically designed for movement patterns that the athlete will encounter during training and competition. The warm up builds in intensity and works through eight different phases: Low intensity movements, technical build up and body focus, muscle activation circuits, ankle position focus, dynamic mobility circuit, technical build ups, wall sprint series and acceleration power work (21). Each specific warm up has either a linear emphasis or a lateral emphasis, depending on the stage of training for the individual. While some of the movement patterns may sound complicated, for example prone scorpion and fire hydrant series, to the informed trainer they are dynamic movement patterns concentrating on coordination of the athlete and hip mobility. These factors are crucial when completing explosive and dynamic movements. The key factor in these warm up segments is the muscle activation phase. The muscles are being prepared for movement and as stated earlier “stretching is not a warm up activity”.

A dynamic warm up of similar nature has been employed at Queensland Cricket with resounding results. Members of the Queensland Academy of Sport and Elite Player Squads have been exposed to this warm up for twelve months and have endorsed its value to their performance. The Queensland
Bulls players have been exposed to the dynamic warm up for twelve months also and have completely endorsed its value to their performance in the 20/20, One Day Competition and Sheffield Shield Competitions (Appendix A). One senior player when first exposed to the dynamic warm up commented, “I can see the value of the dynamic warm up, as I stretch three times during the day of a game and when I take my place on the field, I feel extremely flat” (12). This reiterates the point that static stretching relaxes the muscle and this is no way to prepare for elite performance.

**DYNAMIC WARM-UP**

Dynamic warm-up should be used before training and prior competition. Static stretches should be performed on a daily basis but not ideal in game or training preparation. Static stretching is suitable for long term flexibility and should be treated as a separate training session.

**CONCLUSION**

After examining the literature available and conversing with elite athletes and coaches on the topic of athlete preparation, dynamic stretching certainly dominates the warm up in some sports. Traditional stretching routines will remain firmly entrenched in the minds of some sportsmen and women and some elite coaches. The statement made by Dr. Istvan Balyi that “flexibility is not a warm up activity” is very apt. Sportsmen and women should not lose sight of the fact that flexibility remains an important component of fitness but it should not be utilized in the warm up.

When the athlete is preparing for competition they do not want to feel “flat,” and that is exactly what the research conducted by Calder, Balyi and Alter on static stretching have deduced. A message is sent from the muscle to the brain whilst static stretching is occurring for the body to relax. The contraction of muscles while undertaking static stretching is slower and this is not an appropriate preparation for an athlete who requires activation of muscle fibres. To use the analogy of what a person does after waking, yawn and long stretch, immediately after that process, one feels like continuing to sleep or lie down. It is exactly the same process when a long slow static stretch occurs prior to training or competition. This is not an appropriate way to prepare for performance.

Static stretching should not be eliminated from a training program but used as a separate training component of fitness like strength or speed. The athlete must remain flexible but carry out long slow stretching programs post training or competition. Tom Kurz, a leading flexibility expert, challenges the accepted belief that static stretching should be employed after an initial warm up routine. He contends that “doing static stretches before a workout consisting of dynamic actions is counterproductive”. Instead, he advocates using dynamic stretches first and static stretching when the major part of the workout is completed and it is time for cool down (14).

Movements that prepare the body physically and psychologically for performance require movement. Calder says the question should be, “How can we train athletes to perform efficiently?” rather than “How can we prevent athletes from getting injured?”. Some of the misconceptions about flexibility and stretching stem from the application of poor logic to known information. For example, biomechanists tell us that an athlete needs to be flexible and strong enough to perform movements efficiently. (This is logical). Physiotherapists and biomechanists tell us that if athletes are inefficient or have poor mechanics/skill/technique due to poor flexibility they are more at risk of injuries than an efficient performer of the same caliber. (This is also logical). These logical concepts have been married and translated into coach education programs to read that static stretching in the warm up will prevent injuries in training. (This is stretching the truth). This illogical thinking pattern has permeated training stretching philosophies in Australia for over twenty years and it is very difficult to change (4).

In an age where sport is professional and coaches and athletes alike require their best performance every time they set foot on the field surely common sense must prevail and deduce that completing a long slow static stretch prior to performance will decrease the athlete’s chances of performing to his/her optimum. It is no coincidence that the leading teams in AFL, Cricket and Olympic athletes all attribute the dynamic warm up to playing a part in their success. Let’s get the message across to coaches, athletes and our muscular system to “switch on” rather than “switch off”.
REFERENCES