Flexibility in Sport

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One of the most neglected aspects of sports training is flexibility or suppleness. Considerable time is devoted to improving strength, stamina, style and speed, but little or no attention is paid to flexibility training. Almost all sportsmen commence a training session with what they term a “warm-up”. Too often this warm-up is based on archaic, traditional methods which do not include appropriate or scientific flexibility exercises. A jog around a field, vigorous arm-swinging, sit-ups, toe-touching, press-ups and “bunny-hops” frequently constitute the average warm-up.

Few training instructors seem to appreciate that any rapid movements activate the muscle stretch-reflex which initiates contraction, or stiffening, of the muscle. Moreover, any strenuous initial activities cause a detrimental accumulation of fatigue by-products in the muscle, as well as irregularities of heart beat in many people. Rapid movements during the early phase of a workout can also lead to muscle, tendon or ligament damage particularly if the warm-up session has not been structured to focus the sportsman’s attention on correctness of style. On several counts, therefore, the traditional fast-motion, endurance-type warm-up is potentially harmful, and at best, little more than useless.

For years, virtually the only persons to integrate flexibility exercises into their training were gymnasts and ballet dancers. Fortunately, scientific evidence and feedback from sports doctors and physiotherapists is now convincing increasing numbers of sportsmen that flexibility is vital in all sport.

Among the many benefits of proper flexibility training are the following 1,2,3:
- reduction in the incidence of injury
- decrease in the severity of injury
- delay in the onset of fatigue
- increase in the range of useful movement
- increase in level of skill and efficiency
- improved mental outlook
- prolongation of sporting life
- prevention and alleviation of muscle soreness4,5

It is important to note that, even when no injury occurs, lack of flexibility has adverse effects on the efficiency of movement. If a muscle is required to lengthen to its limit or somewhat further, it will require extra energy to execute the movement, since there are two forces opposing it:

1. the muscle tension caused when the stretch-reflex is activated near the limit of joint movement
2. the tension created by the extension of the muscles and other soft tissues such as tendons and ligaments.

Short, tight muscles will elicit the stretch-reflex sooner and operate against the intrinsic tension over a greater range, so greater flexibility will contribute to enhanced efficiency of movement.

Fortunately normal muscle is able to be stretched to between 150 and 160 percent of its relaxed length before breaking and hence provides another safeguard to injury, in addition to the stretch-reflex which limits the range of rapid extension. 6 It should be appreciated that an increase in relaxed length of muscle will contribute to diminishing the possibility of injury.

Prolonged muscular soreness or stiffness after exercise may be caused by ischaemia (temporary lack of blood supply) and fatigue, with its concomitant accumulation of fatigue by-products which maintain nervous activity, elicit muscle spasm and prevent complete relaxation. De Vries has shown that strained, sore muscles display an increase in electrical activity. Static stretching movements are able to reduce the electrical activity significantly and simultaneously diminish muscle soreness. 5 Furthermore, it was found that stretching exercises are particularly effective in preventing muscular soreness if used to terminate a workout.

The relative contributions of the various body tissues to joint stiffness are as follows 7:
- muscles and their fascial sheaths 41%
- structures of the joint capsule 35%
- skin 11%
- tendons 10%

Since little or nothing can be done to modify the physical characteristics of the joint capsule and the inherent degree of inextensibility of tendons and ligaments, the more elastic muscles and fascia comprise the tissues which can contribute the most to increase of flexibility by appropriate exercises. Despite the relative inextensibility of ligaments and tendons, controlled strain on these tissues may increase the formulation of fibres in them, thereby contributing to enhanced elasticity and strength in the connective tissue of the joint 8.

A remark has to be made about the popular concept of one becoming “muscle-bound” due to weight training. Many studies have revealed that weight training does not reduce flexibility and that Olympic weightlifters are amongst the most supple of all sportsmen 8,9,10. Whenever flexibility is adversely affected by weight training, it is due to technique which limits the range of movement. According to Morehouse and Rasch, 11: “It is now generally accepted that an individual becomes muscle-bound when he consistently exercises one muscle or group of muscles in a fixed position which does not permit a complete range of motion, with the result that connective tissue in the muscles become adapted...
to this position and become shortened”. This fact is true of all exercises, including those which do not involve weights or heavy resistance. Limited flexibility may be caused by regular repetition of any limited range movement or by neglect of any movement associated with operation of a specific joint.

It is interesting to note that a combination of stretching exercises and weight training used as a supplement to a sprint-training programme for athletics actually produced significantly greater increases in speed over an unsupplemented sprint-training routine.

Flexibility is influenced by the following factors:

1. Exercise
   Regular exercise, particularly that which involves a wide range of movement, generally enhances flexibility. It should be noted, however, that sportsmen tend to develop patterns of flexibility which are characteristic of their particular sport.

2. Age
   Stiffness generally tends to increase with age, and hence susceptibility to muscle injuries increases. Regular exercise combined with flexibility training can minimise the effect of these physiological changes. Flexibility is not at a peak in the youngest children. There are differences between males and females, but maximum flexibility seems to be reached between the ages of 10 and 12 years.

3. Temperature
   An increase in muscle temperature, for instance, due to a warm-up or massage increases flexibility. An appropriate gentle warm-up session is therefore recommended prior to flexibility training.

4. Sex
   Females generally tend to be more flexible than males in equivalent joints.

5. Type of joint
   Flexibility is specific to each joint. It may be somewhat misleading to categorise one person as being more flexible or supple than another. One person may have very flexible hips, but stiff shoulders, while another may display the reverse situation. Overall flexibility may be determined by averaging the flexibility of a large number of joints, but what is more valuable is establishing the flexibility of the most important joints used by a participant in a particular sport.

6. Type of movement
   Movement of a joint may involve one or more of the following types of displacement:
   ● flexion — extension
   ● adduction — abduction
   ● rotation
   ● impaction — distraction
   ● antero — posterior gliding
   ● medio — lateral gliding
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The degree of flexibility is different for each one of these modes of displacement in order to maintain static and dynamic stability under a wide range of loading. It is important to avoid increasing flexibility in any mode which may adversely affect the stability of a joint vital to the execution of a specific sporting manoeuvre. The indiscriminate use of too many yoga positions may be detrimental in this respect. It is extremely important to remember that optimum, and not maximum, flexibility is required for a specific joint and a specific movement. In fact, sportsmen who are already hyper-mobile in certain joints should avoid exercises which increase flexibility.

There are at least four different types of stretching exercise which may be used to improve flexibility 6:

1 Static exercises
These exercises, similar to yoga asanas or positions, are used to stretch muscles slowly as far as possible without causing pain, and to hold them in the required pose for up to a minute.

2 Ballistic exercises
These bouncing exercises use the momentum of a particular part of the body to stretch a muscle beyond its normal statically stretched limit.

3 Passive exercises
These exercises rely on externally applied force or momentum to stretch a muscle. A training partner may exert additional force on a sportsman to extend the range of a static stretch or he may add momentum in form of extra bounce to achieve a similar effect with a ballistic stretch.

4 Contract-relax exercises
These exercises are drawn from the physiotherapy rehabilitation system known as PNF (proprioceptive neuromuscular facilitation), which also requires a partner to constrain a sportsman to follow a specific pattern of movement. PNF manoeuvres are designed to make optimal use of the stretch reflex and its inverse, the stress (or tendon) reflex, which is involved with the relaxation of contracted muscle. By contracting a muscle before it is stretched, the stress reflex signals the muscle to relax. To utilize this mechanism, the sportsman stretches the relevant muscle, then an assistant helps him hold this position while he isometrically contracts that muscle for 5 to 10 seconds. He then relaxes and returns to static stretching, either on his own or with the aid of his assistant.

All the above methods are effective in increasing flexibility, although the ballistic method is not advisable for use by amateurs because of its high injury risk. Ballistic stretching may recruit the stretch reflex and contract a muscle while the sportsman is forcing it to lengthen, a situation which not only requires more force to achieve stretching, but also increases the possibility of injury. Moreover, the ballistic method requires greater expenditure of energy, leading to inefficiency and unsuitability for warming up routines.

In both the partner assisted methods (passive and contract-relax stretching), the practical problem is that two people are necessary for every manoeuvre, which doubles the time required for sufficient flexibility training. In addition, correct execution of the stretching manoeuvres is usually learned formally by physiotherapists alone, and an unskilled partner can apply an inappropriate or excessive load which can injure the muscles. Amateurish therapy of this nature may not cause pain or acute injury, but it can still promote the formation of micro-tears in muscles, tendons or ligaments which can eventually lead to structural instability and injury.

Static exercises are simple to learn, easy to execute, safe and most suitable for the average sportsman who does not always have a coach or training partner available. Several passive or contract-relax exercises may be used by sportsmen who have been carefully taught the correct techniques of application. These may be of particular benefit to the sportsman with certain muscles whose flexibility does not seem to improve significantly with static stretching.

Studies have revealed that stretching exercises, when properly executed, have a prolonged effect on flexibility. For instance, Hansen found that initial gains in flexibility measured directly after a flexibility routine for the lower back and hamstrings lasted for 3 hours, declined slightly after 6 hours and still remained significant after 24 hours. Jacobson showed that the increase in flexibility due to a 3 week stretching programme was still significant 7 days after its cessation, while McCue found measurable gain in flexibility even 8 weeks after a 3 week stretching programme 6.

Beaulieu provides a useful summary of points to be observed by any sportsman or trainer when establishing a flexibility programme.

1. One should concentrate on stretching the major muscle groups used in that particular sport and include some exercises for stretching the body generally.
2. An individual routine is most effective, although a general programme produces good results. A screening programme to measure each sportsman’s capabilities is valuable in the design of individual routines.
3. Each flexibility session should last from 10 to 20 minutes.
4. Daily stretching is important for optimum
gains in flexibility, except for persons who are inherently excessively supple.
5. A light, non-stamina type warm-up should always precede the flexibility exercises. A tracksuit may be useful in keeping the muscles warm when the air temperature is low.
6. Stretching before and after a workout is desirable, though the pre-workout session is most important.
7. Hyper-flexible sportsmen should not aim to increase their flexibility any further.
8. Significant increases in flexibility are gradual; the sportsman should be mentally prepared for this situation.
9. A static stretching routine is generally the safest and most advisable.
10. Exercises should be executed slowly with no jerking or bouncing. One should never stretch to the point of pain.
11. Exercises should progress gradually from the simple, mid and brief (15 seconds) to the complicated, more demanding and prolonged (45-60 seconds).
12. Both sides of the body should be stretched.
13. The body should be released slowly from any stretched position, particularly when passive exercises are used.
14. One should concentrate on relaxing the muscles as much as possible while they are being stretched, if necessary by using visualisation techniques.
15. Stretching exercises are not meant to be competitive.
16. Successful programmes are based on educating and motivating participants as to the importance of flexibility training.
17. The flexibility programme should continue during the off-season.
Flexibility training should be integrated carefully into every workout so that the body is gradually prepared and progressively stressed.
The activity phase of the training session should, in the interests of safety and efficiency, follow the sequence recommended by the Russians 13.

Technical and Tactical Skills  Speed and Agility  Strength  Endurance

After strenuous exercise, blood tends to pool in the extremities of the body and the cessation of physical movement deprives the heart of the supplementary pumping action of the muscles which contribute to venous return of blood to the heart. The continuation of light activity during the recovery period not only diminishes this extra loading on the heart but also assists in the removal of toxic exercise by-products which accumulate in the neuromuscular system. Should exhaustion render light activity impossible it is preferable to lie flat with legs raised rather than to remain in an upright stationary position. This will at least minimise the tendency for blood to pool in the lower extremities and lead to faintness or more serious cardiovascular consequences.

References