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Dynamic Flexibility Training

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STRENGTH AND CONDITIONING coaches and those involved in the training and rehabilitation of athletes know that improving flexibility is an important goal within the conditioning program because increased flexibility can help prevent injuries and enhance performance.

The purpose of this article is to provide a basic review of flexibility training and the various flexibility methods available and to describe the dynamic flexibility training exercises used in the athletic training programs supervised by the author.

The Importance of Flexibility Training

Flexibility is defined as the range of motion (ROM) of a joint or a series of joints (1, 5). Flexibility is an important aspect of any sports program, especially when the activity is dynamic and demanding in nature. Optimum flexibility provides increased resistance to muscle injury while also helping to eliminate movement that is awkward and/or inefficient. This has the effect of improving athletic performance (2–5, 7).

Because of these important benefits, coaches should supervise stretching sessions as they would any other part of practice. Doing this communicates the importance of the warm-up/stretching period and may encourage athletes to keep their attention focused on the task at hand (6).

Factors Affecting Flexibility

Flexibility is influenced by a number of factors, which include the following:

- Gender plays a role in flexibility. Typically, women are more flexible than men (1). It has been found that elementary-school girls are superior to boys in flexibility, and it is likely that this difference exists throughout adult life (5).
- Age also plays a role in flexibility (1). Investigators have found that elementary-school children become less flexible as they grow older, reaching a low point between ages 10 and 12. Flexibility normally improves at this point, but never reaches the level found during early childhood (5).
- Flexibility increases with heat and decreases with cold temperatures (1).
- Studies show that physically active individuals are usually more flexible than inactive individuals. This is because connective tissues tend to become less pliable when exposed to a limited ROM, which would be seen in people with a sedentary lifestyle (5). A decrease in activity level will result in an increase in percent body fat and a decrease in the pliability of connective tissue. Further, an increase in fat deposits around the joints creates obstructions to ROM (5).

Flexibility Is Joint-specific

It needs to be pointed out that flexibility is normally highly specific to the joint being evaluated. It is possible to have a high level of flexibility in 1 joint and limited ROM in another (1). Because of this, performing a single flexibility test as a measure of overall flexibility is invalid (1).

Connective Tissue Target Area When Stretching

When stretching, connective tissue (muscles, ligaments, and tendons) is the most important target of ROM exercise. Although muscle is not considered a connective tissue structure, evidence indicates that when a relaxed muscle is stretched, perhaps all of the resistance to stretch is derived from the extensive connective tissue framework and sheathing within and around the muscle (5). Under normal circumstances, connective tissue is the major structure limiting joint ROM. ROM is primarily limited by 1 or more connective tissue structures, including ligamentous joint capsules, tendons, and muscles (5).

Types of Stretch: Elastic and Plastic

There are 2 types of stretch that occur: elastic and plastic. An elastic stretch is a springlike action in which any lengthening of the connective tissue that occurs during stretching is recovered when the load is removed. As a result, elastic stretch is a temporary condition. In contrast, the elongation that occurs in a plastic stretch remains, even after the load is removed (5).

Muscle only has elastic properties. However, ligaments and tendons have both plastic and elastic properties. When connective tissue is stretched, some of the elongation occurs in the elastic tissue elements and some occurs in the plastic elements. When the stretch is removed, the elastic deformation recovers, but the plastic deformation remains (5).

Obviously, stretching techniques should primarily be designed to produce a plastic deformation because a permanent increase in ROM is the goal. When stretching, the proportion of elastic and plastic deformation can vary depending on how and under what conditions the flexibility training occurs. Emphasizing stretching to the point of mild discomfort, holding the stretched position for a period of time, and stretching only when the core temperature has been elevated will assist in emphasizing plastic stretch (5).

The Value of Warming Up

Warm-up and stretching are not the same thing. Warm-up is an activity that raises the total body temperature, as well as the temperature of the muscles, to prepare the body for vigorous exercise (1). The increase in tissue temperature that occurs during warm-up is the result of 3 physiological processes: (a) friction of the sliding filaments during muscular contraction, (b) the metabolism of fuels, and (c) the dilation of intramuscular blood vessels (4).

Theoretically, the following physiological changes take place during warm-up and should enhance performance (1):

- The temperature increases within the muscles that are being recruited during the warm-up session. A warmed muscle contracts more forcefully and relaxes more quickly. Because of this, both speed and strength should be enhanced during exercise.
- The temperature of the blood as it travels through the working muscle increases. It is an established fact that as blood temperature rises, the amount of oxygen it can hold becomes reduced (especially at the partial pressures in the muscle). This makes available more oxygen to the working muscles.
- The ROM around joints is increased because elevated core temperatures lower muscle, tendon, and ligament viscosity.

Because of these changes, many researchers believe that stretching should occur only after warming up (5). The benefits of increasing muscle temperature prior to flexibility training are accepted by a majority of strength and conditioning professionals. The physiological responses that occur after warming up warrant the continuation of the warm-up as a method to prepare the body for flexibility training (5).

Unfortunately, the prepractice warm-up program often consists primarily of static stretching. There are 3 distinct disadvantages to using static stretching to increase core temperature: (a) static stretching is a passive activity and there is minimal friction of the sliding filaments occurring; (b) there is little, if any, increase in the rate of fuels being metabolized; and (c) there is no need for the intramuscular blood vessels to dilate in response to static stretching.

Because of this, athletes using static stretching to warm-up begin practice with minimal core body temperature elevation (6). This means that they are missing out on the benefit of increased core temperature: decreased viscosity of the muscle, which reduces muscle and joint stiffness. The decrease in viscosity leads to increases in ROM, which provides protection to the body against sudden, unexpected movements (4).

As suggested by McBride (7), the warm-up is part of the foundation of a successful practice session. Getting fully warmed up, mentally and physically, is a key aspect of achieving a training intensity required to achieve optimal results. Unfortunately, many athletes attempt to take shortcuts in the warm-up procedure, which translates into a poor workout or competition (8).

Types of Warm-up

There are 3 types of warm-up methods: passive, general, and specific. Regardless of the warm-up method chosen, the general purpose of warming up prior to physical activity is to increase muscle temperature (4). The 3 warm-up methods are the following:

1. The passive warm-up. Passive warm-up involves such methods as hot showers, heating pads, or massage. Most research has shown that passive warm-up methods do not achieve the desired increases in tissue temperature.
2. The general warm-up. General warm-up involves basic activities that require movement of the major muscle groups, such as jogging, cycling, or jumping rope. Because of the large muscle mass recruited in these types of activities, general warm-up is more effective at increasing tissue temperature than is passive warm-up. Thus general warm-up seems more appropriate than passive when the goal is preparing the body for demanding physical activity.
3. The specific warm-up. Unlike the general warm-up, specific warm-up includes movements that are an actual part of the sport activity, such as a baseball player taking batting practice or a quarterback throwing passes during pregame warm-ups. Specific warm-up has the advantage of not only increasing tissue temperature but also allows rehearsal of the event about to take place, allowing complex skills to become better integrated. Thus the neural aspects of the specific warm-up becomes a factor. Because of this, specific warm-up has the added advantage of both increasing tissue temperature and improving neural responses required in the activity.

Because of the many benefits of warming up, a quality flexibility program should always begin with activities designed to increase core temperature. Body temperature should be elevated to a point that the athletes have broken out in a sweat before beginning flexibility work (7).

During warmup, "the ROM around joints is increased because elevated core temperatures lower muscle, tendon, and ligament viscosity."

■ Types of Flexibility Training

A variety of stretching methods are used to maintain or increase flexibility. The 3 most common methods for increasing flexibility are ballistic, static, and various proprioceptive neuromuscular facilitation (PNF) techniques (5).

Ballistic Techniques

Ballistic (bouncing) stretching is a rapid, jerky movement in which the body part is put into motion and momentum carries it through the ROM until the muscles are stretched to the limits (5).

One of the negative aspects of ballistic stretching is that the increased flexibility is achieved through a series of jerks or pulls on the resistant tissue. Because these movements are performed at high speeds, the rate and degree of stretch and the force applied to induce the stretch are difficult to control (5). Ballistic stretching, although widely used in the past, is no longer considered an acceptable method for increasing ROM in any joint. When comparing static and ballistic stretching techniques, 4 distinct disadvantages of ballistic stretching should be considered (2):

1. There is an increased danger of exceeding the extensibility limits of the tissues involved.
2. Energy requirements are higher.
3. Muscle soreness, which static stretching will not cause.
4. Activation of the stretch reflex.

The stretch reflex occurs in response to the extent and rapidity of a muscle stretch. As the athlete bounces, the muscles respond by contracting to protect it from overstretching. Thus the internal tension develops in the muscle and prevents it from being fully stretched (5). An example typically used to describe this reflex is the knee-jerk response. When the patellar tendon is struck, the tendon, and consequently the quadriceps muscle, will experience a slight but rapid stretch. The induced stretch will result in activation of muscle spindle receptors within the quadriceps (5).

Static Stretching

Static stretching is perhaps the most commonly used method to increase flexibility. Static stretching involves passively stretching into a near maximal position and holding for an extended (15–30 seconds) period of time. Achieving the static stretch should be done slowly and only to a point where minor discomfort is felt. The feeling of tension should diminish as the stretch is held, and if it does not, the stretched position should be reduced slightly. This method will likely avoid activation of the stretch reflex (5).

Proprioceptive Neuromuscular Facilitation

PNF, originally developed by physical therapists, is widely accepted as an effective method of increasing ROM (5). The PNF procedure involves slowly placing the muscle or joint in a static stretch while keeping the muscle relaxed. Following this static stretch, the muscle is briefly contracted isometrically against an external force acting in the direction of the stretch. This force should be sufficient enough to prevent any movement in the joint. The muscle or joint is taken out of the stretched position briefly and a second stretch is performed, potentially resulting in a greater stretch. The isometric contraction will result in the stimulation of the respective Golgi tendon organs, which may help maintain low muscle tension during the terminal stretching maneuver, allowing connective tissue length to further increase and result in increased ROM (5).

In a study evaluating increases in ROM resulting from static and PNF stretching procedures, it was found that although both procedures resulted in increased flexibility, subjects using the PNF method gained the most ROM.

PNF is clearly the best method. Although some studies suggest that PNF stretching produces better results, it can be impractical to use. Part of the difficulty of using the PNF method is that a partner is often needed. This partner must be very careful to not overstretch the muscle. This stretching method can be dangerous unless each person is familiar with the appropriate techniques, because too much emphasis can be placed on flexibility and not enough on correct technique (5).

■ Dynamic Flexibility

Dynamic flexibility has been used for some time, but it is not common knowledge to many coaches. Although it is most commonly practiced in track and field sports, it is slowly catching on in other sports (7). Dynamic flexibility training is not as commonly used as the 3 methods just discussed, but there are some unique aspects of this method that may warrant its use in the training programs of athletes. There are few sports in which the ability to achieve a high degree of static flexibility is advantageous to performance, although activities such as gymnastics and diving may be exceptions (5). Because of the principle of specificity, dynamic flexibility may be more applicable to athletic performance because it more closely duplicates the movement requirements seen in training or competition.

Dynamic stretching consists of functional-based exercises that use sport-specific movements to prepare the body for activity. Dynamic flexibility programs are developed by analyzing the movements associated with a sport activity and developing stretches to enhance flexibility and balance based on these movements (6).

In addition, dynamic flexibility training can be used to teach or emphasize sport-specific movements needed during practice or competition (6). As training progresses, dynamic stretching exercises can be made more effective by progressing from a standing position to a walk and then into a skip or run. Replacing static stretching exercises with dynamic ones is not difficult. Many times, the actual stretching exercise is the same, but it is preceded and followed by some form of movement.

It is recommended that coaches wishing to implement dynamic flexibility programs begin dynamic stretches in the preseason or earlier (6). Because dynamic flexibility exercises require balance and coordination, athletes may experience muscle soreness for a short period of time when dynamic flexibility training is introduced.

The following is a list of dynamic flexibility exercises and a brief description of each drill. Because dynamic flexibility exercises are based on movements that occur in sport, this is by no means an all-inclusive list of dynamic stretches that can be used. The number and types of stretches used is limited only by the creativity of those designing the flexibility training program. All of the exercises described here are performed while walking over a distance of 20–30 yd.

1. The lunge walk. Clasp your hands behind your head. Step forward and then drop into a lunge position. Do not allow the knee of the forward leg to drift forward of the toes; the back knee should be just off the floor. The head is up and the back is arched, and the torso should be leaning back slightly. Pause for a count in the bottom position and then repeat with the opposite leg, progressing forward with each step.
2. The lunge walk/palms to floor. With the hands at the side, step forward and then drop into a lunge position. Do not allow the knee of the forward leg to drift forward of the toes; the back knee should be just off the floor. At the bottom position place each palm on the floor with the fingers pointing forward. Pause for a count in the bottom position and then repeat with the opposite leg, progressing forward with each step.
3. The twisting lunge walk. Clasp your hands behind your head. Step forward and then drop into a lunge position. As you drop into the

lunge position, twist the upper body so that the left elbow touches the outside of the right (forward) leg. Pause in that position for a count, then twist so that the right elbow touches the inside of the right leg. Do not allow the knee of the forward leg to drift forward of the toes; the back knee should be just off the floor. The head is up and the back is arched, and the torso should be leaning back slightly. Repeat with the left leg, touching the outside of the leg with the right elbow and the inside with the left elbow. Progress forward with each step.

4. The hockey lunge walk. Clasp hands behind your head. Step forward, placing the front foot about 8–10 in. wider than shoulder width, and then drop into a lunge position. Both feet should be pointing directly forward. Do not allow the knee of the forward leg to drift forward of the toes; the back knee should be just off the floor. The head is up and the back is arched, and the torso should be leaning back slightly. Pause for a count in the bottom position and then repeat with the opposite leg, progressing forward with each step.
5. The reverse lunge walk. Clasp your hands behind your head. Step backward and then drop into a lunge position. Do not allow the knee of the forward leg to drift forward of the toes; the back knee should be just off the floor. The head is up and the back is arched, and the torso should be leaning back slightly. Pause for a count in the bottom position and then repeat with the opposite leg, progressing backward with each step.
6. The reverse twisting lunge walk. Clasp your hands behind your head. Step backward and then drop into a lunge position. As you drop into the lunge position, twist the upper body so that the left elbow touches the outside of the right (forward) leg. Pause in that position for a count, then twist so that the right elbow touches the inside of the right leg. Do not allow the knee of the forward leg to drift forward of the toes; the back knee should be just off the floor. The head is up and the back is arched, and the torso should be leaning back slightly. Repeat with the left leg, touching the outside of the leg with the right elbow and the inside with the left elbow. Progress backward with each step.
7. The walking side lunge. Turn sideways with the right shoulder pointing in the direction you are going. Take a long lateral step with the right foot. Keeping the left leg straight, sink the hips back and to the right. Do not allow the right knee to drift forward of the toes on the right foot, and keep the back arched. Pause for a count at the bottom, stand up and then pivot and repeat the movement with the left leg leading.
8. The lunge out on all fours/walk hands between. Lunge out on all fours, with the body extended out and supported on the hands and feet. While keeping the hands stationary, walk the feet up between the hands. The legs should be kept straight. At the top of the movement, lunge out on all fours again and repeat the movement. Attempt to get the feet slightly further through the hands each repetition.
9. The walking knee tuck. Step forward with the left leg and then, using your hands to assist you, squeeze the right knee up and to the chest. Pause for a count, then step with the right leg and repeat the action with the left leg. Try to pull the knee slightly higher with each repetition.
10. The walking knee tuck/lift the foot. Step forward with the left leg and, using your hands to assist you, squeeze the right knee up and to the chest and then pause for a count. While remaining standing on the left leg, move your right hand to your right foot and pull your leg back and up, trying to pull the foot to shoulder height behind you while standing tall. Pause for a count, then step with the right leg and repeat the action with the left leg.
11. The walking over/under. Turn sideways with the right shoulder pointing in the direction you are going. Imagine a series of high and low hurdles progressing down the track. First swing the right and then the left foot up and over the first high hurdle. After clearing the first high hurdle, drop into a squat position and move laterally under the first low hurdle. After moving under the low hurdle, pivot so that the left shoulder is now pointing in the direction you are going and repeat the movement, first going over and then under the next 2 hurdles.
12. The walking leg swing to opposite hand. Take a step with

the left leg and then swing the right leg up and over shoulder height, touching the left hand. Keep the leg straight during the swinging motion. Repeat with the opposite leg and hand, attempting to swing the leg slightly higher with each repetition.

13. Walking knee over hurdle. Imagine a line of intermediate hurdles running down the track, alternating to the right and left sides of the body. Leading with the right knee, lift the right leg up and over the first hurdle. Place the right foot down and repeat the movement with the left leg. Attempt to get the leg slightly higher over the hurdle with each repetition.

As the athlete becomes proficient at performing each drill, the exercises can be combined. For example, the athlete can perform a knee tuck to a lunge walk, alternating legs after each movement has been performed. The possible combinations of exercises are nearly limitless. There are 2 primary advantages to combining movements. First, it becomes a more sport-specific way to train because in most sports the athlete does not perform the same movement in a repetitive fashion. Second, it becomes a more time-efficient way to train because a larger number of muscle groups are stretched when performing a combination of stretches, rather than duplicating the same stretch repeatedly.

Conclusion

Dynamic flexibility provides a more sport-specific mode of stretching than does the other more commonly used stretching techniques. When performed after an effective warm-up session, dynamic flexibility can be a very effective method of developing flexibility necessary to perform a variety of athletic skills safely and effectively. The variety of dynamic stretches that can be used are limited only by the creativity of the person designing the flexibility training program. ▲

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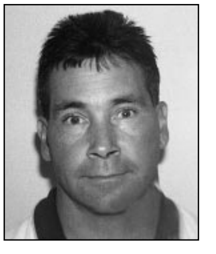

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