Stretching for Dance

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Flexibility is an important part of fitness for dancers, as high levels of flexibility are required to meet the choreographic demands placed on performers today.[1, 2] Flexibility can be defined as the ability of a joint to move through its full range of motion (ROM). It can increase within a specific program and decrease after a period of inactivity.[3] Dancers are often associated with large ranges of motion, but these are normally very joint specific. For example, Spanish dancers require good ROM in the shoulders while having hip ROM similar to that of the non-dancing population; classical ballet dancers, on the other hand, require extensive ROM around the hips and normal levels at the shoulder. In recent years the ROM that dancers need has increased drastically; this is especially seen in classical ballet, where the height of the développé in Les Sylphides has increased from 60° to nearly 180°. There are two types of ROM, passive and active. The former describes ROM when an external force (another person, for instance) moves the limb as far as it can go, while active ROM relies on muscular strength to move the limb (e.g., use of the hip flexors in a développé devant).

It has been reported that up to 17 factors can affect flexibility, including age, body morphology, genetics, gender, bones, nerves, muscle, ligaments, and connective tissue.[1] Koutedakis and Sharp[4] found that 85% of factors limiting flexibility are related to the joints, such as articulating bone and cartilage surfaces and ligaments. The main structure whose length can be altered is the muscle unit. Short of any genetic disposition to passive flexibility, the most effective way of achieving any measure of flexibility is through some form of stretching. The aim of this article is to look at the different stretching techniques available to dancers, our research comparing two of these stretching techniques, and how stretching is best integrated into dance training. The article will not cover specific stretches for dancers, as dance is not generic enough to allow us to prescribe stretches that are ideal for all dancers. However, the principles discussed in the following sections can be applied to any form of dance and any muscle.

Physiology of Stretching

There are a variety of adaptive mechanisms that occur as a result of stretching. The potential links between the observed effects, their causes and consequences still remain elusive. The mechanisms most researched in humans are structural and neurological. Brooks, Fahey and Baldwin[3] note that of all the factors involved, the connective tissue adaptations can show the greatest improvements in ROM due to their potential to increase permanently in length. Since a permanent increase in ROM is the main goal of any dancer's stretching program, effort should be aimed at using stretches that permanently increase a muscle's length. However, as some muscles provide postural stability and need to be stiff,[5] caution must be taken as to which muscles are being stretched. Neural adaptations can be two-fold. First, the myelin sheath that surrounds the nerves needs to be stressed gently (aggressive stress can cause "tethering," which results in muscle spasm, pain, and tingling along the path of the nerve).[6] Secondly, neuromuscular monitoring of the muscle's status is initiated by nerve endings, such as the nerves of the muscle spindles. These nerves monitor muscle length and need to adapt to the increased ROM so that it continues to provide relevant information about its length. Rapid increases in length, such as occurs in an ankle sprain, result in incorrect information being relayed back to the brain, causing increased instability and reduced proprioception.[7] The Golgi Tendon Organ (GTO), found in the muscle tendon, adapts by reducing its autogenic inhibition reflex, thereby allowing more force to occur within the muscle before its protective mechanism causes it to contract. That said, as with mechanical adaptations, there is no current consensus on a singular mechanical adaptation due to stretching.[6, 8]

Review of Stretching Techniques

There are five main methods of flexibility training: static, active, dynamic, and two forms of proprioceptive neu-

romuscular facilitation (PNF).[9] **Static stretching** involves taking the limb to a position where tightness is felt, and then holding that position. As the position is held, the mechanical structures gradually elongate, and over a period of time the plasticity (permanent deformation) of those structures increases, thereby increasing the ROM. Research provides varying information on the optimal length of time the stretches should be held, varying between 15-60 seconds for a single or multiple repetitions.[10] The intensity at which the stretch is held is usually reported at 8/10 intensity which is just below the point when the muscle starts shaking (this is when the autogenic inhibition reflex starts to protect the muscle by causing it to contract).[11]

Active stretching involves contraction of the agonist muscle, the muscle doing the work, to allow the antagonist, the opposite muscle, to stretch (e.g., contracting the quadriceps allows the hamstrings to stretch). This type of stretching replicates most dance movement and develops flexibility and strength at the same time, though it is often the most under-utilized method by the dance community. The intensity and duration of the stretch are usually determined by the strength of the agonist muscle, and the achieved ROM is much less than that seen in passive methods.[9]

Dynamic stretching is unlike other techniques in that the limb is never held in a specific position for a prolonged period of time. Here the limb is taken through its ROM, from full contraction to full extension, at a controlled, slow to moderate speed, as in performing a fondue or plié.[9]

PNF methods have been adapted from physiotherapy techniques.[12,13] One is contract-relax (CR), in which the muscle to be stretched is first isometrically contracted (muscle length remains the same) for up to 10-15 seconds prior to being stretched[14.] This initial contraction causes the nerve endings to prevent the muscle from contracting, thereby allowing for greater ROM to be achieved during the subsequent stretch phase. The next PNF method (contract-relax-agonist-contract, or CRAC) is a progression from the first, but during the stretch phase the opposite muscle is contracted to move the limb into greater ROM, causing the muscle being stretched to relax. For example, first you employ CR on the hamstrings and then, during the stretch phase, contract the quadriceps to move the leg, allowing the hamstrings to relax and stretch a little more.

There are several lesser used techniques, of which **ballistic stretching** is the most controversial, but also the one that most closely replicates dance movement[1] (e.g., grande battement and a split jump). It is important to remember that it isn't the technique that is contra-indicated, but how the stretch is executed. To carry out ballistic stretching safely the muscle needs to be conditioned/trained, have a good ROM, and be introduced gradually. Initially mid-range movements should be used at a controlled, moderate speed, and then the speed and the ROM are gradually increased.[9] This technique is beneficial in preparing the muscle for rapid movements, and is often seen being used by sprint athletes just prior to entering the blocks. Dancers can use this technique to prepare for jump sequences.

Micro-stretching© is a technique developed by Apostolopoulos.[15] The underlying theory promotes very low intensity stretching (3/10), as he suggests that higher intensity stretching causes the muscle to contract (muscle shaking/spasm). He feels this can cause damage to the muscle fibers, with the formation of fibrous tissue that further limits ROM. A lower intensity stretch doesn't stimulate this reaction, thereby allowing for lengthening and adaptation in the myofilaments and muscle fibers. Apoulopous also states that the position the person is in is important, as too often the muscle being stretched is not totally relaxed but rather is under tension. For example, if the muscle is involved in balancing, as in a standing hamstring stretch, it cannot simultaneously relax. He suggests that this technique should be carried out two hours post-exercise, when the muscle has returned to a more normal temperature.

Fast stretching is a technique developed by this author, the aim of which is to reset the muscle's length post-exercise. Often during exercise muscles are not used through their full ROM, and afterwards they feel tight and shortened. This is especially seen after high intensity exercise and weight training. The muscle needs to be taken through its full ROM so that its resting length is restored. The technique takes a muscle to its full ROM, but unlike the static method each stretch is held for just 5-6 seconds.

Choosing the Right Stretching Technique

All techniques are not equal, and the correct method needs to be chosen for each situation. There is still a lot of controversy over the effects of stretching, especially pre-exercise. A number of studies have shown that acute static stretching has a short-term negative effect on power,[11, 16, 17] but research hasn't shown whether subsequent exercise negates this effect.[18] Based on a review of the literature and the author's own experience and research, the following techniques are recommended.

Warm-up

The main focus of warm-up is to prepare the body for subsequent exercise.[19] This must include priming the appropriate muscles to move through the required ROM and speed. Rather than stretching every muscle, focus should be on preparing the limbs to be able to move through the ROM demands of the anticipated movement. This probably needs to be achieved through static stretching, with stretches held for approximately 15 seconds. Stretching stabilizing muscles (such as the peroneus longus and brevis in the ankle) could potentially increase instability of joints, and unless the ROM is required, as in turn-out, the author recommends these muscles be left alone. The muscle then needs to be prepared to move at the required speed, and this is achieved initially through dynamic stretching and possibly ballistic stretching when the muscle is very warm if the subsequent movements require high limb speed (e.g., grande battements). It must be emphasized that stretching

is only one component of a warm-up, and should never be the sole aspect.

Immediately Post-Exercise

What is required immediately post-exercise is another area of concern and controversy. Initially it was thought that this was the ideal time to develop and increase a muscle's ROM, but more recent research has suggested that the muscle is too pliable at this time to affect permanent increase in ROM. This author finds the fast stretch technique to be especially useful between classes/rehearsals or after a performance when dancers are expected to leave the theater quickly and there isn't time for a complete warm-down and long stretch.

Recovery Stretching and Development of Passive ROM

As previously stated by this author,[20] the physiological theory behind Micro-stretching© seems beneficial for increasing passive ROM. We exposed 24 dancers to two different stretch conditions over a six-week intervention period. Both groups carried out the same set of stretches, but the intensity of the stretches varied, with one group performing low intensity stretches (Micro-stretching) and the other more intense stretches (8/10). Both groups increased their active and passive ROM, but the Micro-stretching group improved significantly more in both respects. Apostolopoulos[15] also claimed that Micro-stretching promotes healing within the muscles, but this has not yet been proven scientifically. Anecdotally, this author has seen dancers reduce muscle tightness and delayed onset muscle soreness (DOMS) very quickly using this technique. Because the technique is at a much lower stretch intensity it is less stressful mentally and physically, and helps with relaxation at the end of the day.

Developing Functional ROM

There is often too much focus on increasing passive ROM without developing the muscular strength needed to utilize this enhanced range. Active stretching and strength training should be incorporated into a dancer's program. Grossman and Wilmerding[21] demonstrated the benefits of some simple floor exercises for increasing développé height; this author would develop those exercises further by adding exercises standing unsupported in center. It is often beneficial to do these exercises with a partner, as they can provide resistance and recovery (when you exchange roles). An example of this type of exercise is lifting a straight leg as high as possible to the side (développé à la seconde) with the partner cupping their hands underneath the heel. The exerciser can then relax the foot and leg into the partner's hands. It is important for the exerciser to maintain a correct body position during the exercises – spine straight, pelvis properly aligned, and support leg straight. Finally, the exerciser attempts to lift her/his foot out of the partner's hands, without affecting posture. Each repetition should be held for 2-3 seconds before returning the foot to the partner's hands, and 6-8 repetitions are carried out per position. As the height of the développé increases, so do the partner's hand positions, so that the exerciser is working the far range of movement. This can be painful, and the muscles can become fatigued very quickly; therefore, technique and maintenance of correct posture are all-important. Once these have been compromised, rest is required and the partner can become the exerciser.

Summary

Stretching is a vital aspect of dance to provide the dancer with the ROM necessary for artistic expression. This review has shown that stretching alone is not enough, and more thought is often required to select the correct technique to prepare, develop, or recover the muscle. It is also a good idea to start each stretch session with a different muscle, as otherwise some muscles will always be over-looked, which could limit or compromise movement. Every few months review what you are doing or prescribing, according to the developments achieved.

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