Muscular Imbalance Explained

Muscles are responsible for maintaining posture, creating positions, absorbing shock, producing heat, protecting the body’s internal organs and stabilizing and moving joints. Muscles account for approximately 40-45% of an average adult’s body mass. They are comprised of muscle cells, which are the only human cells able to produce active tension. This means that muscles are able to shorten, lengthen or maintain the same length against a resistance. For example, the leg works against gravity when working in the air or against ground reaction forces when controlling landings from jumps.

Safe and healthy movement and function in dance relies on effective muscle balance. Muscle balance can refer to the length and strength relationship between the agonist (the muscle most responsible for a given movement) and antagonist (the muscle opposing that given movement). For example, in a grand battement, the muscles at the front of the thigh (quadriceps and hip flexors) are the agonists and the muscles at the back of the thigh and bottom (hamstring and gluteus maximus) act as the antagonists. Muscle balance can also refer to the relationship between contralateral muscles (muscles on the right side versus left side of the body) or dominant versus non dominant limb.

Injuries can occur when the normal function of a movement is impaired by an imbalance between the length and strength of muscles working around a joint. Muscle imbalances tend to be the result of faulty movement patterns, and can be described as a ‘functional pathology’ (meaning a problem associated with movement). There is a high incidence of chronic or repeated injuries in dance, which are often due to faulty movement patterns. Therefore, the functional contributors to injury should always be explored.

Muscle imbalances in themselves are not painful. However, when they reach the point of affecting joint mechanics or altering movement patterns, they can lead to injury and pain. It is worth noting here that injuries that are not associated with muscle imbalance (for example, if you go over on your ankle and sprain a ligament), may also affect movement patterns in an attempt to avoid pain, and consequently lead to muscular imbalance. Therefore it is important to highlight that dancing through any pain can indirectly lead to muscle imbalance. In short, muscle imbalance can be a symptom or a cause of many injuries.

Muscles adapt in response to postures and repetitive movements. It is anticipated that the body will carry some muscle imbalances. For example, the muscles in your quadriceps might be stronger than those in your hamstrings. However, when an imbalance impairs normal and healthy movement patterns, it can lead to injury.

Faulty movement patterns may begin as biomechanical imbalances and over time turn into neurological imbalances.

Biomechanical

Biomechanical imbalances result from prolonged postures or repetitive movement patterns. Agonist muscles may respond to these postures or movement patterns by shortening and antagonist muscles may respond by lengthening. Prolonged postures and repetitive movement patterns will also ultimately lead to specific muscular weaknesses. The associated joint then moves in an unhealthy way resulting in microscopic trauma, which can lead to pain and injury. For some examples of common biomechanical imbalances please see Box 1.

Neurological

Poor alignment resulting from biomechanical imbalances can lead to neurological muscle imbalances. Dancing with faulty alignment for prolonged periods of time can change the proprioceptive feedback to the brain about that movement, and that movement pattern becomes habitual. If repeated over the course of a dancer’s training, it can result in weakening of key muscles. This may lead to the brain acknowledging unhealthy movement patterns as correct.
Local and Global Stabilizers

An additional consideration in muscle balance is the functional health of stabilizing and mobilizing muscles. Stabilizing muscles protect the joints from harmful forces imposed by the muscles that are more responsible for movement. Stabilizing muscles can be local (close to the joint) or global (further away). The role of the local stabilizers is to help to keep the joint in a neutral (healthy) position. When functioning correctly, these muscles should start working before movement, meaning that they activate in anticipation of the movement about to take place. If there is a muscle imbalance, they lose their ability to do this job effectively. The global stabilizer’s role is to control the joint position throughout its range of movement. However, if the local muscles are not working effectively, the global muscles try to take on the job, exacerbating the imbalance.

Mobilizing muscles

Mobilizing muscles are responsible for functional movement. They are more superficial than the stabilizing muscles and fatigue easily, therefore they cannot effectively stabilize the joints. When stabilizing muscles become compromised, for example due to pain or injury, the mobilizers have a tendency to become short and tight. They attempt to take on the extra workload, potentially resulting in faulty mechanics that can leave a joint more susceptible to injury.
Common dance-specific faults

The following section will consider some common dance specific faults that may be a symptom or consequence of muscle imbalances that predispose dancers to injury.

Knee Alignment

Ideal knee alignment requires good muscle balance and therefore plays a key role in preventing injury in dancers. When standing in parallel or turned out, bending the knee or landing from a jump, dancers should take care to ensure that their knees are correctly aligned with their feet and hips. Correct alignment ensures that the knees are travelling over the centre of the foot and not falling in from the hip. This alignment is managed in part by the deep external rotator and abductor muscles of the hip joint. Dancers who land with an inward facing knee (Figure 1) may be under-utilising their deep external rotators and abductors which can become weak and exacerbate faulty alignment.

The level of external rotator activation required for correct knee alignment can depend on the foot position – for example a parallel position will require a lower level of activation as compared to a turned out position, which would require a higher level of activation. High levels of activation, if held for prolonged periods of time, can unfortunately lead to shortened and tight muscles. The external rotator muscles attach on the pelvis and spine. Increased tightness in these muscles may change pelvic placement, which can lead to incorrect joint alignment and pain. Prevention strategies should include stretching techniques for the hip external rotators (Figure 2).

Pelvic alignment

Common postural and biomechanical faults in dance practice are ‘tucking under’ caused by a posteriorly tilted pelvis (Figure 3) and ‘arched back’, which can be caused by, among other things, an anteriorly tilted pelvis (Figure 4).

Tucking under can lead to short and tightened abdominal muscles with long and weak hip flexors and spinal extensor muscles. As hip flexors are used in dance for any movement of the leg in front of the body, weakness may predispose these muscles to injury, particularly if they are not conditioned for the repetitive forces placed upon them. If the tucking under has resulted in muscle imbalance, strengthening exercises for the hip flexors and back extensors alongside stretching exercises for the abdominal muscles are recommended.
An anteriorly tilted pelvis (resulting in an ‘arched’ lower back appearance), may be the symptom or the cause of tightness in the hip flexors and / or lower back alongside weakness in the abdominal muscles. Tight hip flexors can reduce the amount of turnout available at the hips. Additionally, due to the attachment of the psoas major muscle (an important deep hip flexor) to the bones in the spine, tightness in this muscle can influence the position of the lower spine, predisposing a dancer to lower back pain and injury. When the pelvis is tilted anteriorly, the hamstrings are lengthened at their pelvic attachment; on the ‘sit bones’. This can lead to long and weak hamstrings, which is commonly associated with hamstring strain. An additional concern in dance practice associated with tight hip flexors is any movement of the leg behind the body. If the hip flexors do not allow full range of movement, the pelvis will need to compensate by further tilting forward putting even greater strain on the lower back. To avoid injury associated with anterior pelvic tilt, exercises should focus on stretching the hip flexors and back extensor muscles and strengthening the abdominal muscles.

Whether muscle imbalance is the symptom or the cause of an existing or previous injury, every effort should be made to address the fault for effective recovery from and avoidance of further injury. Simple guidelines to avoid muscle imbalances should be:

- Throughout your dance training, strengthen what you stretch, and stretch what you strengthen.
- Get yourself a yearly medical screen. This will allow any muscular imbalances or niggles to be dealt with before they become a more serious problem. It is important to use a dance medicine specialist who understands the demands placed on the body and can advise accordingly. For assistance in finding a practitioner to suit your needs visit www.danceuk.org/healthier-dancer-programme or www.nidms.co.uk
- Always avoid aggravating activities when in pain or injured unless specifically prescribed otherwise by a registered practitioner

FURTHER READING: