Dancing Our Feet Off Without Injuring Them, by Linking Our Warm-Ups to Kinetic Chains

Keith Eric Grant, Ph.D.

Introduction

Every dancer would agree that the enjoyment of dancing is not derived from watching others dance, while letting your own injuries heal. Equally, your enjoyment of dancing is not enhanced by having to dance through minor pains and injuries. Yet either one or the other of these situations seems to occur too frequently in the practice of Scottish Country Dancing (SCD).

As with any athletic endeavor, it is unlikely that the pursuit of SCD will ever be without its casualties. Any means of artistic locomotion, that emphasizes turn out (lateral rotation from the hips) while simultaneously requiring landing on the ball of one foot or the other in quick succession, is bound to produce some injuries. Despite this, we should have an underlying goal to minimize the frequency and severity of such injuries. As with many human activities, the question of whether the human body was really designed to perform in this manner is moot, since we adherents to the practice of SCD are not about to be reasonable.

One of my approaches to the goal of minimizing injuries is to think about the objectives of the movements we use for warming up and conditioning. In a previous article (Grant, 1997), I presented some basic concepts and effects of warm-ups and conditioning exercises. In this article, I explore a bit deeper into the concepts underlying the choice of warm-up and conditioning exercises. Given the limited time allotted to warming up and the diverse skill levels of dancers in many classes, what criteria can we use to choose or design warm-up exercises?

In response to some recent ideas and queries on my part, fellow orthopedic massage instructor and author Whitney Lowe commented: “One of the things that is often stressed in conditioning circles that doesn't often get translated to everyday common activities is the idea of specificity of training. And this should also extend to specificity of warm-up in my mind. That means that the best method of warm-up (or training) would be activities that mimic the physical demands placed on the body during the activity.”

This same need for specificity of effort was voiced by exercise physiologist Owen Anderson (1997) in an article on preventative conditioning of the Achilles tendon *in Running Research News* (RRN). Let’s delve a bit deeper into this concept of making a warm-up exercise specific to the stresses imparted by SCD.

Making Designer Warm-ups Fit the Need

The concept of specificity yields several considerations. To mimic dance movements, a warm-up should occur in several planes of movement and involve multiple joints. To prepare for the stresses of launching and landing dance steps, a warm-up should also have the element of weighting. In dance, movement is not just in a sagittal (front to back) plane, but can find some weight bearing in multiple displacements of the knee relative to a vertical line through the ankle. So the goal is indeed to provide a controlled (i.e. in speed and percentage of weight-bearing) manner of conditioning and warming up that realistically treats a multitude of planes including rotational (torque) components. Practicing the movements should also improve our dynamic stability and our perception of our balance. Vern Gambetta, the conditioning consultant for the U.S. Men's 1998 World Cup Soccer team, terms such exercises “functional

movements". He stresses his belief in the importance of doing functional conditioning as compared to exercises for isolated muscles.

We want our warm-ups to mimic the actual stresses our feet, ankles, and legs will face in dancing. At the same time, we do not want the imitation to be so perfect that it produces the very injuries that we wish to avoid. Therefore, especially when starting off cold, the movements should be controllable over a wide range of skill levels. We definitely want to avoid starting a class with movements in which unfamiliarity with a sequence of movements could result in a sudden jerk to regain lost balance and direction or result in a near collision with other dancers. Situations in which we react to the unexpected are best met with well-warmed, elastic muscles. By their nature, warm-ups should have elements of familiarity and boredom.

Finally, a good warm-up must be practical in a class setting. No matter how wonderful its physical effects, a warm-up will not get done if it requires special equipment, if it is not amenable to normal class dress, or if it requires lying on a cold or dusty floor. Keeping these basic considerations for effective warm-ups in mind, let's link our thoughts to some physiological concepts about *kinetic chains* from the realms of athletic training and rehabilitation.

Connecting Through our Kinetic Chains

Kinetic chains can be thought of as muscles that intrinsically work together to coordinate movements and that can transmit stresses over an extended anatomical line. Structural bodyworker Thomas Myers has explored concepts of kinetic chains using the terminology *anatomy trains*. With some exceptions, anatomy trains are tracks of muscle and tendon or connective tissue that either show a direct continuity of fibers or are directly connected through a bone. Anatomy trains discussed by Myers include: a superficial back line from the plantar surface of the toes up the posterior body and over the skull to the brow ridge; a superficial front line from the dorsal surface of the toes, up the anterior legs, through the pelvis, and up to the mastoid processes; and a lateral line from the metatarsal bones of the foot to the mastoid process, cross-stitching the lateral torso. The anatomy train / kinetic chain concept provides a context for considering how local symptoms may result or be relieved via changes in global lines of stress.

Now I'll move from the basic concept of a kinetic chain into the application of what are known as *open and closed kinetic chain exercises*. In an article from his newsletter on orthopedic and sports massage, Whitney Lowe (1998) commented, "Closed kinetic chain exercise (often called just 'closed chain') refers to the segment of the body that is rigidly fixed when performing the movement or exercise." "In a closed chain exercise the extremity that is being exercised is pushing or pulling against a fixed object." ... "An open kinetic chain, or open chain, exercise is just the opposite." In open chain exercise, the extremity that is moving is not rigidly fixed but moving in relation to the rest of the body." "There is some other part of the body that is rigidly fixed, but the extremity that is performing the movement in question is freely moving in space." Admittedly the open and closed chain concept can overlap and blur in activities such as bicycling, but understanding the concepts and language can provide useful insights in characterizing an exercise.

Having learned some of the relevant terminology, let's now take a look at some applications. We'll start with the idea that part of moving with a relaxed minimalist control comes from learning to perceive and work with our own balance. Another part comes from having our central core muscles well developed so that they can stabilize our motions and efficiently transmit the power of our legs into our upper bodies.

Conditioning Our Core

In another article on conditioning for runners, Owen Anderson and Walt Reynolds (1997) presented a number of useful exercises for strengthening our core muscles. These include things like standing on one foot while moving your arms horizontally in front of you from side to side or

extending one arm and then the other upwards above your head. At advanced levels, hand weights are used. One of these exercises, using light hand-held weights, has the feeling to me of doing a Nordic skiing diagonal stride with my upper body while balancing on one leg. As with running or dancing, these exercises require use of our inner core muscles to stabilize and transmit movement efficiently through our pelvis. Without this muscular development, there is unwanted compensatory movement throughout our body and more wear on the body.

In another RRN article, Walt Reynolds (1999) discusses balance board training and provides a number of exercises. Balance boards are either rocker boards that rock in one plane or wobble boards with a hemisphere under them so that they wobble in all directions. These boards have long been used to rehabilitate following injuries, but are recently finding increased use in conditioning to prevent injury. They also directly address training our perceptions and experience of balancing over our feet. Reynolds comments:

"Exercises with a balance board are especially effective at improving the strength, mobility, flexibility, and elasticity of the muscles, tendons, and ligaments which run between the knees and toes. These structures include the intrinsic muscles of the feet, the plantar fascia, the plantar and dorsiflexors of the ankle, and the Achilles tendons. All of these anatomical components help to stabilize and control the foot and lower part of the leg during the footstrike portion of the gait cycle and in particular govern and coordinate 'pronation', the natural inward movement and rotation that occurs at the ankle immediately after the foot hits the ground."

With the terminology we developed above, we can identify that what Walt Reynolds is advocating in his article on wobble board training is an implementation of conditioning via closed kinetic chain exercises. While the wobble board does allow some movement, the weighted foot upon it basically stays fixed in place while the body above it compensates for the shift in angle. Now let's look at warming up for SCD from the perspective of open and closed chain exercises.

Rejoining the Dance

In Scottish country dancing, warming the knees and ankles is often (i.e. traditionally) done via open chain movements. The leg is hung in the air in front of one with the knee flexed and pot-stirring movements are done from the knee. Then the knee is extended and rotations are done at the ankle.

Perhaps it would be more effective to place the ball of the foot on the floor, and then do closed chain warm-ups of the ankle and knee by rotating the knee around the fixed foot. The pressure on the foot, ankle, and knee would be controlled by the amount of weight dynamically transferred from the supporting rear leg to the front leg being exercised. This almost takes the form of a Tai Chi movement pattern. Such a closed chain warm-up would better prepare the involved structures for the weight- bearing activities (e.g. landing a step) of actual dancing than would the more often used open chain exercise.

The knee does have some rotational capability when flexed, but that is not what I am emphasizing above. If you projected the motion of the knee onto the horizontal plane at the vertical level of the ankle, then you would have the ankle in the center with the knee "rotating" around it. This is similar to what you would see in one-legged balance exercises on a wobble board. However, most of the apparent rotation of the knee around the ankle comes from the ankle and hip joints. Thus we find an instance of the multi-joint, multi-plane, weighted exercise that we explored earlier in this article – an example of a functional movement.

The amount of weighting given to the extended leg can be varied greatly to suit the desires and knees of each individual. Bringing the leg closer to the body, almost into third position, allows a person to do small circles with little weighting, most of the weight staying on the supporting leg. With the active leg extended further from the axis of the body, the movements and leg-to-leg weight trans-

fers become larger. This form of exercise can also be easily modified to prepare the dancer for the lateral movements of a slip-step.

In closing, the traditional open chain exercise is not without its own benefits. It is good training in proprioception and neuromuscular patterning for the free leg movements found in ballet and in lady's step dancing. In these examples, as compared to SCD steps, control of the free leg in the air is emphasized. Finally, the exercise that is open chain for the leg in the air is also a closed chain exercise for the supporting leg. It provides balance training and exercise of the core muscles necessary to provide stability and power transfer through the pelvis. However, the open chain exercise does not strike me as the best place to start beginners or to begin a warm-up session, but more as a place to go as muscles warm and balance is learned. Hopefully, by increasing our understanding of and working with the concepts I have explored above, we can dance a little easier and a lot longer.

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References

Anderson, Owen, 1997: How to Make your Achilles Heel your Rock of Gibraltar, *Running Research News*, **13** (1), Jan-Feb 1997: 1-6, (http://www.rrnews.com/).

Anderson, Owen, and Walt Reynolds, 1997: "Strengthen Your Core (Your Abs and Low Back) and Run Faster!", *Running Research News*, April 1997, 10-12, (http://www.rrnews.com/).

Gambetta, Vern and Gary Gray, 1997: Following the Functional Path (http://www.gambetta.com/articles/a97004.html)

Grant, Keith Eric, 1997: "Tender Loving Care for Dancer's Legs – Understanding, preventing, and treating injuries in Scottish Country Dancers", *TACTalk*, **22** (1), Teachers' Association Canada, Peterborough, ON (This article was reprinted in The Journal of Soft Tissue Manipulation, **5** (2), Winter 1997/1998, Ontario Massage Therapy Association, 7-10).

Laskowski, Edward R., MD; Karen Newcomer-Aney, MD; Jay Smith, MD, 1997: "Refining Rehabilitation With Proprioception Training: Expediting Return to Play", *The Physician And Sportsmedicine*, **25** (10), (http://www.physsportsmed.com/issues/1997/10oct/laskow.htm)

Lowe, Whitney, 1998: "Kinesiology Corner: Open & Closed Kinetic chain Exercise", *Orthopedic & Sports Massage Reviews*, Issue #21 (March/ April 1998), Orthopedic Massage Education & Research Institute, 9-10, (http://www.omeri.com/)

Myers, Thomas W., 1997: "The anatomy trains", *Journal of Bodywork & Movement Therapies*, **1** (2), Churchill Livingston, 91-101.

Reynolds, Walt, 1998: "Balance Board Training: A Unique Way to Improve Your Running", *Running Research News*, December 1998, (http://www.rrnews.com/),

Biography

Keith Eric Grant is a senior instructor of Sports and Deep Tissue Massage at the McKinnon Institute in Oakland California. In another facet of his life, he is a physicist, using computers to model the effects of mankind on atmospheric chemistry and climate. As dual vocations and family permit, he pursues the avocations of Scottish Country Dancing and Scandinavian couple dancing.