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The Truth on Fitness:
BALANCE (Part 2)

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In our previous segment, we introduced the concept of balance, or equilibrium, as the interaction between the body's center of gravity and base of support. We also related this concept to the notion of stability, which is a state of balance, or the relative degree to which one can remain in equilibrium. Being more stable makes it easier to maintain balance, while less stability implies that balance is more precarious.

Stability has both advantages and disadvantages, depending upon the functional goal. If the objective were to remain stationary, for example, a high degree of stability would be advantageous. On the other hand, if one wanted to move quickly from one position to another, too much stability would hinder displacement, and would be a disadvantage. Often, finding just the right amount of stability is essential to successful function.

To a large extent, one's stability is a product of their movement goals, the nature of their position in space, and the relative displacement of their center of gravity. This reflects the types of functions in which we engage. Functional activities may be divided into two broad classifications. In the first, the goal is to establish body stability, a product of static equilibrium. In the second, the objective is to transport the body through space, an action involving dynamic equilibrium. Thus, to appreciate the challenges that one faces in maintaining balance, and the applications that would best improve one's ability to do so, one should first understand the difference between static and dynamic balance.

In a static balance function, the objective is to remain still, even if parts of the body are in motion. An example is reaching up to change a light bulb. Here, the performer has to create an elongated posture with arms held over head. Then, of course, there are the actions of grasping the bulb and rotating the wrist. Despite the fact that the goal is to maintain a fixed position, the subtle movements of the arms and hands and the postural shifts that naturally occur, cause motion at the center of gravity, which may affect stability and disrupt balance.

Static equilibrium is influenced by two additional factors. First, as already discussed, is the base of support. Even in a body stability task, there is some movement of the center of gravity. A small base of support, therefore, doesn't allow for much movement error because the distance from any edge of the base to the center of gravity has decreased. Thus, the task becomes more difficult as the size of the base shrinks.

The other influence on static equilibrium is the application of an external force. If one, while maintaining a stable position, were to be pushed or pulled by another object or person, then their balance could be

jeopardized. Maintenance of static equilibrium would then depend on how effectively one could reposition their center of gravity towards a pushing force or away from a pulling force, and generally, how well they could resist the force that would otherwise cause a fall.

Dynamic equilibrium is created during body transport tasks. In body transport, the objective is to displace the center of gravity in order to move the body through space. This usually involves moving the center of gravity beyond the base in order to initiate motion, and then forming a new support base to re-establish equilibrium.

It's worth emphasizing that the center of gravity is deliberately moving, hence the "dynamic" nature of the task. Some movements are more dynamic than others, determined by the amount of mass being moved and the velocity of the movement, or in other words, the momentum. Simply stated, the more momentum created during body transport, the greater its dynamic state. The resulting challenge to equilibrium, therefore, is a product of a task's inherent momentum, the size of the supporting base, and the direction of movement.

Movement of the body may occur vertically, as in vertical jumping; horizontally, when walking or running; or some combination of both, as in leaping, or long jumping. Vertical tasks are challenging from the perspective of having to generate enough force to leave the ground and return smoothly. But in terms of maintaining equilibrium, this dynamic movement is relatively simple, so long as the supporting base remains large. Since, by definition, the center of gravity is moving vertically, its position relative to any edge of the supporting base, once established, remains fairly constant. Only when the base becomes much smaller, such as landing on one foot, or if the center of gravity is too close to the base's edge, does the task become demanding, as there is now greater potential for a shift in the center of gravity beyond the limits of the base.

One might surmise, then, that horizontal movements at the center of mass have greater demands on balance control. If the center of gravity is moving horizontally, across the base of support, then at some point, it will pass beyond the boundary of the base and balance will be lost. Of course, this too is influenced by the momentum of the center of gravity and the size of the base. Consider the possibilities, starting with a slow movement over a large base, and then ultimately, a rapid motion over a small base. The demands on the performer become increasingly difficult.

Let's, consider, for example, a leap, which is defined as jumping off of one leg and landing on the other. Envision someone leaping over a puddle, thus creating movement at the center of mass which is both vertical and horizontal. This is a fairly dynamic task, since the performer must generate enough force to get off the ground, thus creating quite a bit of momentum at the center of gravity.

Interestingly, while the performer is airborne, he is technically falling, but the real challenge occurs the instant the lead foot touches the ground. At the moment of contact, a new base of support is established, but being the size of the foot, it is a pretty small support surface. At that same instant, the center of mass is actually well behind the base, but moving rapidly in that direction. The problem for the performer is to gradually arrest the movement of the center of gravity so that it continues its motion until it is over the base, where it must stop in order to preserve equilibrium. Stop it too soon, or too late, and the result is a fall. This only gets harder as speed increases.

The truth is, balance is not simply the ability to stand quietly on one foot while moving slowly up and down. Static and dynamic conditions test us constantly, whether during normal daily activities or in sporting events. These tasks require some degree of strength, power, timing, and coordination. It's no wonder that even very fit people sometimes struggle with these challenges.

To develop a better approach to improving balance, one should first understand how it is maintained during static and dynamic conditions. In our next segment, we'll explore the mechanisms that we use to control balance, finally leading up to a discussion about the types of exercises that can best improve our ability to manage static and dynamic equilibrium.

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