AIKIDO INSIGHTS

Breathing Mechanisms in Aikido

by James Loeser

You are midway through a few rigorous Aikido exercises, and you realize that your face is turning red because you have been holding your breath the entire time. As regular cleaning of machine elements is required to keep an engine functioning smoothly, breath is an important, essential part of any sustained bodily movement. Most marital artists will tell you that you are most powerful when you exhale or *kiai* –a shout delivered for the purpose of focusing all of one's energy into a single movement. Olympic track and field coaches instruct their sprint athletes to hold their breath when they assume the set position in the starting blocks, roughly one second before the gun goes off, and continue holding it until they are several steps out of the starting blocks, thereby producing an effect tantamount to a silent *kiai*. Either way, many martial artists and athletic experts consider breath control an integral part of any reflective, explosive movement.

In humans, breath control is initiated and maintained by the central nervous system (CNS). First, the CNS must produce a rhythm for the periodic cycle of contraction and relaxation of respiratory muscles. Second, the CNS must adapt and adjust this rhythm so that the appropriate inhalation and exhalation of the lung is maintained for proper blood gas (dissolved oxygen and carbon dioxide) homeostasis. Third, the CNS must integrate respiratory movements with other body movements such as speech, swallowing, postural changes, and locomotion.

To produce rhythmic respiratory action, the CNS operates by utilizing aggregates of motoneurons – nerves that connect directly to and stimulate muscles. Motoneurons responsible for the breathing mechanism originate at the brainstem (rear side of the lower head and upper neck) and extend to the lumbar (lower back) regions of the spinal cord; motoneurons carry an excitatory signal from the brainstem, down the spine, to respiratory muscles, which contract upon stimulation. The minimum neural circuitry necessary for the pattern generation of rhythmic breathing is contained within the pons and medulla, located within the brainstem. In mammals, rhythmic contraction of the respiratory muscles continues to function even after the cerebrum and cerebellum have been removed. The cerebrum controls higher cognitive function, such as thought, logic, emotion, and memory, and the cerebellum is responsible for the regulation and coordination of complex voluntary muscular movement as well as the maintenance of posture and balance. Thus, the brainstem alone is responsible for rhythmic generation of your breath patterns; moreover, breathing patterns can persist even if the rest of the brain is clinically dead. However, simple rhythmic breathing is not conducive to survival in a dynamic world, and the CNS must adjust breathing patterns to adapt to changing internal and external environments.

When you engage in strenuous exercise, your tissues require increasing amounts of oxygen to maintain heightened activity levels. The CNS must determine how much to increase breathing rate to adequately supply the body with oxygen, while expelling used up oxygen in the form of carbon dioxide. To determine the adequacy of ventilation and to optimize the effort expended in breathing, the CNS depends upon feedback from chemoreceptors. Chemoreceptors are molecules on the surface of cells in the body that respond to specific chemicals or molecules, such as oxygen, and their essential function in breathing is to provide information to the brainstem about the status of respiratory gases (oxygen and carbon dioxide) so that optimal activity levels can be maintained. If chemoreceptors –found in major blood vessels– detect increased levels of carbon dioxide or decreased levels of oxygen, they send this information to the brainstem. The brainstem then sends signals to the respiratory muscles to increase the tempo and depth of breathing. The major respiratory muscles that make breathing possible are the diaphragm, which separates the abdominal (stomach) and thoracic (chest) cavities, and the intercostal muscle groups, which are located between the ribs. Normal breathing is accomplished by contracting the dome-shaped diaphragm downward into a flat shape. This contraction increases the volume of the thoracic cavity and lowers the pressure inside the lungs. Since air prefers low pressure to high-pressure environments, air is sucked in through the nostrils, travels down the windpipe, and enters the lungs

(i.e., inhalation). We exhale by relaxing the diaphragm –a primarily passive process– into its original dome shape, which decreases the volume of the thoracic cavity and raises the pressure inside the lungs, thereby, pushing the air inside the lungs to a lower pressure outside the lungs. During heavy breathing the intercostal muscle groups are engaged, in addition to a deeper diaphragm contraction, which lifts the rib cage up and outward, further increasing the volume of the thoracic cavity and drawing more air into the lungs. In addition, muscle groups in the throat and neck may be contracted or relaxed to decelerate or accelerate forced airflow created by the respiratory muscles. Furthermore, muscles of the abdominal wall (external abdominal oblique, internal abdominal oblique, transversus abdominis, and rectus abdominous) may be contracted, stabilizing the spine during heavy lifting or sudden, explosive movement.

With the scientific understanding of breathing outlined, we can better appreciate, from a Western point of view, the importance of breathing in Aikido. Aikido ("Ai" = blending, joining; "Ki" = internal, life energy; "Do" = way, path) training requires a holistic retraining of the of the mind and a complete reconfiguration of the muscles in the body is necessary; one must learn to deconstruct their present conceptual system and unlearn all previously learned and conditioned responses. Technique alone is not sufficient in Aikido; the psychophysiological state of the Aikidoka is more important than the mechanics of movement. Aikido proficiency requires one to *extend* Ki, and the Aikidoka must be in a *centered* state of being to successfully do so. Aikido techniques should be executed through one's *hara* –the location of one's spirit (source of Ki) and one's center of mass, located about two inches below the navel. One's awareness radiates outward from the *hara*, bestowing equanimity, stability, and freedom from doubt and anxiety. The *hara* is also the one's physical center from which all major muscle groups symmetrically radiate. Fundamental Aikido skills teach one to begin movement from the *hara* and allow this initial movement to flow outward into one's surroundings. Once aware of your *centered* physical state, you may begin to enter a *centered* mental state of being. When you are *centered* physically and mentally, you can effectively *extend* Ki. Thus, a *centered* state of being requires both a physical and a mental transformation.

To *extend* Ki, one must *center* both the physical and the mental organism. In Japanese culture, breath joins the mind and the body, and breathing techniques are used to attain a *centered* state. In Aikido, Misogi (literally, "ritual purification") breathing focuses one's physical and mental awareness in the *hara*. During Misogi breathing, the practitioner comfortably sits seiza (on one's knees) or cross-legged, with spine erect. He slowly draws breath in through the nostrils and to the *hara*, and then he takes a moment to focus all of his awareness in the *hara*. Slowly, he releases his breath from the *hara* and out through his mouth, while visualizing all tension, negative emotion, and illness leaving his body with the expelled breath. After many repetitions, the practitioner will begin to relax and feel revitalized; an experienced practitioner will quickly enter a trance-like, hypnotic state, and, among other experiences, he will "see" a thick, cleansing fog being drawn into the nostrils and a murky cloud exiting the mouth. Therefore, breath is one's peace, freedom, and power, i.e., one's *centered* state. This *centered* state resembles accounts of the physical and mental state of great athletes at the height of achievement, sometimes referred to as "entering the *zone*" in athletics. Similarities between being *centered* and entering the *zone* are thoughtless, reflexive action, heightened awareness of oneself and one's surroundings, time dilation, merged peripheral and focused vision, and diminution of physiological reflex mechanisms.

With the physical and the mental state *centered*, the Aikidoka can now *extend* Ki in the execution of his techniques. First, the Aikidoka must reflexively react to an attack, and, to successfully do so, he must be aware of the automatic system regulating breathing patterns in the body. Second, the Aikidoka must enter and remain in a *centered* state of being, and, to successfully do so, he must become familiar with and eventually learn to control the CNS's response to increased demands of oxygen required to sustain heightened activity levels. Third, he must learn voluntary control over muscles involved in breathing to produce efficient breathing and coordinated, effective movement.

When a beginning student of Aikido is attacked, his unconscious bodily reactions will cause his breathing and movement to be inefficient. His natural breathing pattern will increase in tempo and

depth, causing a greater but inefficient exchange of respiratory gasses. His throat and neck muscles will contract which protect the soft tissues under the muscle but also lead to restricted airflow. Muscles in the abdominal area will contract to form a more solid base, but are often overstimulated, depleting energy reserves. The number and frequency of neural charges will increase causing his senses to be heightened, but the beginner will become overwhelmed by sensory input, causing confusion and disorientation. The increase in neural charges also causes natural reflexes to be enhanced, but can lead to overreaction. All of these natural responses begin with heightened breathing activity, and are inefficient and not conducive to sustained movement. On the other hand, the expert Aikidoka is cognizant of his body's reaction to automatic systems, can control his central nervous systems' response to an attack, and has learned voluntary control over unconscious bodily movements.

By focusing on the automatic breathing pattern generated by the CNS, the advancing Aikidoka will become aware of this natural cycle, and he will soon realize that the natural pattern is often times too rapid for present activity levels. In addition, one will recognize that the throat and neck muscles are tensed up, causing airflow to be restricted. Recent neurological studies of the brain have demonstrated the plasticity of the human brain. In other words, the brain is not immutably "hardwired," and it may reorganize itself to better serve the organism and adapt to its changing internal and external environments. Since we have the ability to retrain our automatic breathing rhythms, we have the ability to customize more efficient breathing patterns; typically a slower, deeper pace is most suitable. Also, the Aikidoka will learn to relax muscles involved in breathing that will up open airflow. Thus, the body will have a more efficient mechanism to supply its tissues with oxygen, while allowing the body to relax by decreasing the number and intensity of neural impulses reaching the CNS's breathing center. Furthermore, the Aikidoka can dampen reflex responses or learn to reconfigure emotional reactions to events, which always seem to accompany the CNS's response to a changing environment, such as a perceived threat or an attack. It is plausible that if we can exert control over our automatic breathing mechanisms, we can exert control over other automatic body responses such as reflex responses or emotional reactions to stressful situations.

Although we can consciously control our breathing patterns and other bodily responses, most of our preprogrammed responses are conducive to our survival. For example, if a man takes an extended series of deep breaths or holds his breath for too long a duration, the brainstem will take over breathing patterns, making it impossible to kill yourself by holding your breath. However, these general, preprogrammed responses, propagated by nature through species, can be altered to better suit the individual. For example, since biomechanics requires muscle force against a stationary object to produce bodily movement, muscle contractions must occur; however, the typical person overexerts himself on simple, preprogrammed movements, such as climbing stairs, because of a lack of efficient movement. So the Aikidoka strives to have the most efficient movement with the least amount of muscle contraction, i.e. the strongest, most supple movement with the least amount of energy expenditure. This means that the Aikidoka's stabilizer muscles, including those around the abdominal area, are minimally contracted to effectively stabilize a base. The same customized alterations can be accomplished in breathing, in emotional responses to stressful situations, in heightening or dampening physiological reflex responses, in heightening perceptual awareness, and in maintaining relaxed, erect posture which is essential to good airflow and efficient bodily movement.

In summary, the first step toward efficient, controlled breathing is awareness; you must concentrate on your current breathing patterns, and you must believe that you can change your nature – because you can. The second step is optimistic, diligent, and patient practice. Systemic body changes do not happen overnight, or even in a few months; they happen over the course of many, concentrated practices. The third and most crucial step is reflection: you must look back upon your progress and acknowledge your small gains in voluntary control over your inherent breathing mechanism. In this way, you can fully utilize the fruits of your endeavors, and you may begin to refine the changes you have made and begin new systemic body changes.

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