To AJKA-International

AJKA-I of PA

Instructor Trainee's Report #14

Subject: **"Body Expansion and Contraction in Karate"**

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Although the human body has more than 400 muscles there are only three types of muscle: smooth, cardiac and skeletal. Each muscle helps to keep you in motion, your heart beating or signal a natural response in your body, such as the ability to keep your eyes focused.

Smooth Muscle: Smooth muscles are also known as involuntary muscles, meaning a person cannot physically will them to move. Instead, smooth muscles are controlled by involuntary responses in the brain and body. Examples of smooth muscles are digestive system, the uterus, the bladder and the muscle behind the eyes that keeps your eyes focused. In terms of appearance, smooth muscles are long, thin-shaped cells attached to bones in the body. Smooth muscles are also found in the blood vessels, helping blood to move around the body

Cardiac Muscle: Cardiac muscle is also known as myocardium. Similar to smooth muscle, cardiac muscle is an involuntary muscle. These muscles are thickened because they must contract frequently to move blood in and out of the heart. Cardiac muscle cells are quadrangular in terms of shape, and the muscles have striations resembling stripes or lines running through them.

Skeletal Muscle: Skeletal muscles are the voluntary muscles that allow you to control the movements of your body. Skeletal muscles also are striated and comprise the musculoskeletal system. These muscles are attached to your bones via tendons, which are cords of tissue. In order to move, your skeletal muscles, tendons and bones all must work together. The major difference between Skeletal muscles and Smooth and Cardiac muscles are that you the person will these muscles to move.

Skeletal muscles come in different shapes and sizes. Other skeletal muscles in the body you may not be as aware of include those in the neck or face. Even your tongue contains skeletal muscles. Major skeletal muscles in the body include the deltoids (shoulders); pectorals (chest); abdominals (stomach); quadriceps (thighs); and gluteal muscles (buttocks). Skeletal muscles often work in pairs, such as the biceps, which bend the arms, which work with the triceps, which straighten the arms. Power is derived from muscular ability. Striated muscles are those that can be voluntarily contracted, such as the muscle groups in the arms and legs. These muscles are the source of power.

The body's center is the engine. As we have discussed in many papers, a person's gravitational center is called *tanden,* or more specifically *seika tanden* - "below the navel". The *seika tanden* is located inside the body in your abdomen (*hara*) area. It is located at least two finger widths down from the bellybutton for a male (55%) and three fingers for a female (56%). Techniques are initiated from a firm center using ground reaction, the body center is also important in transmitting forces from the feet to the arms and vice versa. If the center is unstable, forces from ground reaction will dissipate and will not transfer to technique, as well as stresses will be put on the lumbar spine and sacrum.

The center has to be firm while the bigger muscles around the center, which produce the most force, has to be relaxed and activated according to the task. The smaller muscles around the seika tanden have to be activated before the bigger muscles and also in the right amount, according to the stabilization need. The stabilization needed is different for walking or for sprinting.

Research shows that in healthy individuals the smaller muscles around the sacrum and lumbar spine were firing 30-50 milliseconds before arm movement, and 110-130 milliseconds before leg movement, subconsciously, this is called "feed forward mechanism". For people who had delayed or no activation, there was high likelihood of back pain, since the spine was not stabilized and protected against the movement of the arms and legs. This activation can be learned and this is what we do in karate, activating the center first and connecting the center to the extremities than moving from the center out.

When discussing the seika tanden Master Kanazawa stated:

> The ability to focus power and concentration in the seika-tanden automatically leads to confidence and emotional stability…. A well-set hara enables a person to have confidence in his everyday life. And herein lies the allure of martial arts. The lower abdomen, depending on how it is combined with breathing and the way in which the body is used, can provide a feeling of encouragement in the face of unstable circumstances and conversely, can have a calming effect during times of high tension.
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> Due to the variety of movements employed in karate, concentrating power in the lower abdomen poses a challenge to students … but when the hips unleash a powerful kick it is the lower abdomen that ensures stability throughout the entire motion, from before the kick is delivered to the instant that the kick makes contact and the follow through. It is for this reason that the lower abdomen represents the most important means of self-protection. [1]

The abdomen muscles are made up of two types of Striated muscles fibers: slow-twitch (type I) and fast-twitch (type II). **Slow twitch fibers** give you stamina, not explosiveness. Slow-twitch muscles help enable long-endurance feats such as distance running. They have a high capacity for aerobic energy production and can remain active for a long time while producing relatively small amounts of lactic acid. This is important because lactic acid build-up in the muscle tissue causes the muscle to fatigue and eventually renders it unable to continue working.

Fast twitch gives you explosiveness but they do not have good stamina. Fast twitch muscles are used in powerful bursts of movements like sprinting. Fast twitch fibers have a great capacity for anaerobic energy production, which allows them to produce intense power and speed of contraction. This intensive work also causes them to accumulate large amounts of lactic acid and fatigue quickly.

[1] Kanazawa, Hirokanzu Black Belt Karate The Intensive Course, Kodansha International 1978 pg 14

Fast-twitch muscles break down into two categories: moderate fast-twitch (type IIa) and fast-twitch (type IIb or IIx). Moderate fast-twitch muscles are thicker, quicker to contract, and wear out more rapidly than slow-twitch. Fast-twitch, the most powerful and lowest in endurance and are activated when the body nears maximum exertion. During aerobic exercises such as running or swimming, slow-twitch fibers are the first to contract. When the slow-twitch fibers become tired, fast-twitch fibers begin to take over.

The proper firing order of the muscles is important. In order to achieve maximum force in a technique within a given space, each body segment should be used to the fullest, and then next segment smoothly add force. In karate we want to move from the center out, in order to move from the center out we must have a stable center first.

There are two basic ways that force is generated and controlled. The contraction of a muscle is determined by the types of muscle fibers recruited and the firing rate of the neurons within the muscle. The voluntary contraction of a muscle begins with the recruitment of the smallest units of slow twitch muscles. These muscle fiber groups have the lowest response threshold, create the least amount of tension and are the most resistant to fatigue. As muscle tension increases, more muscle fiber groups are recruited from the larger fast twitch fibers. As tension continues to rise, fewer motor units need to be activated because the large fast twitch units contain more plentiful and more powerful muscle fibers. But because these large fibers are the ones that generate peak tension in the muscle, they fatigue quickly and require more recovery time.

Expansion and contraction of the body is considered one of the six body actions in karate – along with vibration, rotation, shifting, rising, and lowering. Of the six, it is the action most concerned with breathing. Expansion and contraction can apply to either the body core or to the limbs. The core and limbs can act similarly (both either contracting or expanding at the same time) or they can act discretely (one contracting while the other expands). When executing thrusting techniques, such as punching (*zuki*) or thrust-kicking (*yoko geri kekomi*), the limbs are extended out from the body. This is an example of expansion of the limbs. When recovering from striking or snapping techniques, such as a backfist strike (*uraken uchi*) or a front- or side-snap kick (*mae-* or *yoko-geri keage*), the limbs tighten back toward the body. This is an example of contraction of the limbs. It is a rare karate technique that does not involve the expansion or contraction of either the core or the limbs.

Continuous practice of karate is extremely essential. Muscles should be used in order to maintain speed, strength and vitality. Only through repetition will you achieve well-educated muscular system – practice makes permanent.

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