

TWELVE PRINCIPLES OF BODY MECHANICS. By Bob Remington.



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Everyday movement generally utilizes the skeleto-muscular system to facilitate motion. At earlier stages of karate training, students rely on this system to produce the gross movements of techniques, refining these movements through constant repetition. This practice greatly increases the speed and precision of technique, as well as the complexity of muscular use, but it has its physiological limits. Even as we mature in technical proficiency, our bodies are aging and we begin to lose the muscular strength and stamina of our youth.

In order to continue to improve throughout our training careers, a shift from a primarily muscular focus to a more bio-mechanically based practice needs to occur. This shift can be aided by exploring twelve principles of body mechanics. These twelve principles include five attributes of body awareness, four methods of generating power, and three relationships in combinations.

Five Attributes of Body Awareness:

- Maintain a vertical centerline
- Move from the center
- Stay relaxed
- Keep the weight toward the center
- Extend intention

Four Methods of Generating Power:

- Body shifting
- Hip rotation
- Hip vibration

- Core contraction

Three Relationships in Combinations:

- Flow
- Rebound
- Recoil

Five Attributes of Body Awareness:

Maintain a Vertical Centerline:

There seems to be some confusion in martial arts literature on the definition of the term “centerline”. Some authors have used it to describe the line that runs down the center of the head and torso from the top of the head to the groin, along the front of the body; the term “midline” has also been used to describe this line. Others have used centerline to describe the imaginary line that runs from the crown of the head, through the vertical center core of the body, to the perianal area. It is the latter usage that I’ll be using.

Maintaining a vertical centerline aids in three things: increasing economy of motion, maintaining a low center of gravity, and increasing balance.

Imagine the centerline as a beam of laser light shining down through the body’s vertical core. If our posture is erect, this beam is thin, almost to the point of disappearing. With every degree of alignment away from the vertical, the beam thickens; increasing from the thickness of a pencil to that of a small tree limb. Now, imagine that this beam has weight and mass, and as those increase, body movements become increasingly cumbersome. Maintaining the vertical allows the body to move with greater efficiency, especially in rotational movements and angular shifting.

Although there are other factors that affect our maintenance of a low center of gravity, which I'll describe later in the article, the affect of vertical posture can most easily be understood by another visualization. Assume, for now, that our default center of gravity is in the seika tanden, an inch or so below the naval. Imagine that the centerline is a carpenter's level, with a glass, water-filled tube that has an air bubble that determines maintenance of the center. The inconsistency with this analogy is that any variance from the vertical causes the bubble to move in just one direction, up, thus causing the center of gravity to move away from the seika tanden towards the naka tanden, in the middle of the sternum. This upward movement of the center, combined with the loss of the vertical, compromises balance and segments the body; reducing movement as a unified whole.

Move from the Center:

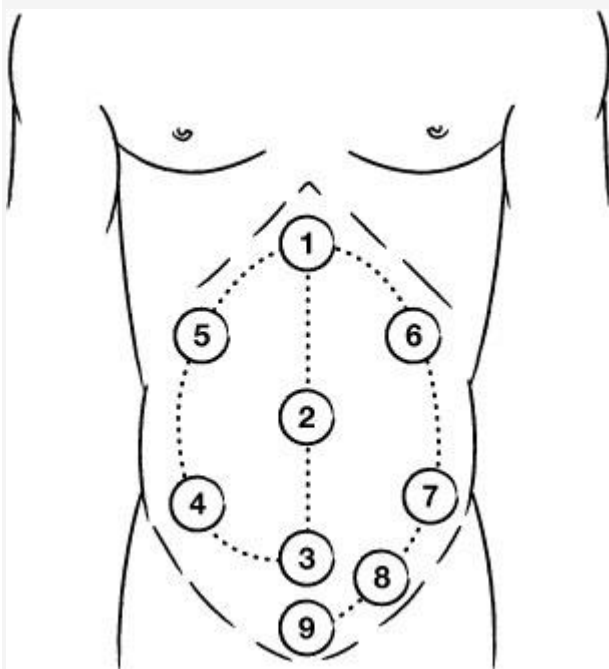
Before moving from the center, we first have to find and maintain a low center of gravity. As mentioned before, the physical (and some would also say spiritual) center of gravity is in the seika tanden. In addition to a vertical centerline, two other factors affect our maintaining this center: breathing and relaxation. All three of these elements are inextricably linked.

Breathing can be centered in two locations; the chest or the abdominal area. From infancy, our natural inclination is to breath diaphragmatically, into the abdomen or hara. The hara includes all of the area below the rib cage and above the pubic bone. As we age, the stresses of everyday life accumulate, causing residual tension in the hara, and constricting our breathing. By adolescence, most of us limit our breathing to the chest. This causes several negative things to occur; it raises our center of gravity, as discussed earlier, increases stress in the body, and reduces the utilization of lung capacity.

When we breath into the chest, we stimulate a bundle of nerves that creates a stress response, which accumulates in the body as residual muscular tension. This creates a vicious cycle since this muscular tension also affects the hara which then perpetuates chest breathing. There are two remedies to this problem: conscious abdominal breathing and self massage designed to open up the hara.

When we breathe deeply into the lower abdomen, we stimulate another bundle of nerves that trigger a relaxation response, which helps to release tension from the body. At a more sophisticated level, we can differentiate abdominal breathing into standard and reverse; also know as Buddhist and Taoist breathing.

Standard abdominal (Buddhist) breathing occurs when the hara is expanded during inhalation and contracted during exhalation. Reverse (Taoist) breathing occurs when we contract the hara during the inhale and expand it during the exhale. Standard breathing is used during most types of martial arts and meditation practices. Reverse breathing is used for some types of Qigong (ki undo, kiko) and advanced breathing exercises. Reverse breathing is also used by advanced karateka during kime.



Shiatsu self-massage chart: Ampuku.



A Shiatsu self-massage technique, Ampuku, is also useful in releasing residual tension and opening up the hara. Ampuku consists of massaging nine points in the hara (see chart) with the fingers; coordinating the pressure with exhaling. While sitting upright or lying flat on your back, place the finger tips of both hands sequentially on each Ampuku point, inhale deeply, then exhale and press the finger tips as deeply into the point as is comfortable. This not only releases residual tension, but revitalizes and cleanses the digestive organs. Ampuku may also improve sleep and reduce insomnia.

Breathing into the chest restricts the utilization of lung capacity to about 30%. Abdominal breathing allows this usage to increase to roughly 70%. It is recommended to retain about 30% of capacity at the bottom of the exhale in order to reduce the risk of a collapsed lung in the event of the receipt of strong impact in the chest or abdomen.

Once the center is found and maintained through breathing, relaxation, and posture, movement can then originate from this vital area. Techniques based on movement from the seika tanden have a unified, flowing, holistic quality which allows for efficient and effective development and transfer of power.

Stay Relaxed:

Relaxation is a process which begins in stillness but must be maintained during dynamic movement. Incorporating body mechanics refines the way that we use the skeleto-muscular system. Every technique uses a series of muscles, contracting in the proper sequence, producing kime at the point of full extension and impact. Relaxation affects these movements in several ways.

Muscles needed later in the sequence must maintain a relaxed state until the antecedent muscles are fully contracted, then contract as quickly and as forcefully as possible at the appropriate moment, only to completely relax immediately after kime. Any premature contraction or on-going residual tension greatly reduces the effect.

The muscles that are needed during the technique, the agonists, are opposed by the muscles that would impede the technique, the antagonists. Either generalized residual tension or an inability to isolate the agonists from the antagonists will cause the antagonists to compete with the agonists in an almost isometric opposition. This is often seen in lower ranking students who “muscle” their way through techniques.

Relaxation begins with stillness.

Experience gained through constant repetition of techniques allows the body to gain the proper sequential motor movements as well as whittle away at antagonistic tension. This results in not so much an increase in strength as in a removal of the tension that impedes a technique, resulting in a natural increase in speed and power. This natural increase in technical competence can be aided by consciously refining breathing patterns.

The most basic breathing pattern that we’re taught in karate is to inhale between techniques and exhale during the extension of techniques. Bearing in mind that inhalation aids in relaxation and exhalation aids in contraction, the question becomes where in the technique is the optimal point in which to begin the exhalation? Maturing practice allows us to refine this process so as to minimize tension and maximize efficiency.

Keep the Weight toward the Center: Related to the concept of maintaining the center of gravity in the seika tanden are the concepts of keeping the feeling of weight on the under side of the arm during the extension of hand techniques and on the upper side of the leg during leg techniques. “Keep the weight under”, is often advised in Aikido dojo and is echoed in Tai Chi literature with the negative admonition, “Don’t float the elbows”. During the course of any hand technique, keeping the elbow at the lowest point, relative to the required form of the technique, increases the connection of that technique with the seika tanden. Keeping the knee at the highest point relative to the required form of a leg technique also increases that connection.

Extend Intention:

The intention to produce a technique precedes the physical manifestation of that technique, albeit often on a subconscious level. However, this intention not only produces the technique, but also extends power through the technique into and through the target by reducing the inadvertent slowing of the technique before contact. This conscious extension of intent increases penetration and effectiveness beyond physical impact.

Four Methods of Generating Power:

Body Shifting:

Body shifting, simply put, is moving the seika tanden from Point A to Point B. This can be accomplished by shifting the weight, sliding the feet, taking a step, rotational shifting, or turning. As in all methods of generating power, body shifting can be used offensively and defensively.

Various stances have different ratios of weight distribution, as well as different foot alignments, angles, and directions. Changes in any of these attributes by shifting from one stance to another will result in moving the seika tanden.

Two methods of sliding the feet are yori ashi and suri ashi. Yori ashi is produced by extending one foot to a wider or longer position, then retracting the other foot to re-establish relative length or width. The opposite occurs with suri ashi; first one foot is retracted, then the other is extended. The descriptors "big-little" and "little-big" can be used for each, respectively.

Stepping occurs when one foot moves past the other foot before the second foot is moved.

Body shifting resulting from these three methods is essentially linear in nature, regardless of angles or directions. There are two methods that are more circular in nature; rotational shifting and turning. These can be considered hybrids; combining the attributes of body shifting with hip rotation.

Rotational shifting can be primarily a rotary movement initiated by the turning of the hips, or combined with a linear cross step which would precede the rotary movement. It differs from turning in two ways; the gaze remains in generally the same direction and it is only used in retreating.

Two types of turns are in place turns and stepping turns. In place turns are initiated by a rotational movement of the hips. During a stepping turn, the rotation is preceded by a linear step. Degrees of rotation, angles of stepping, and direction of movement vary according to need.

Hip Rotation:

Hip rotation is "the starting point of karate". It is accomplished by turning both hips along the same horizontal plane, moving from a fully forward facing position, shomen, to a half forward facing position, hanmi; or vice versa. This results in a 45 degree range of motion. In standard hanmi, the rear hip is moved toward the rear leg. In reverse hanmi, the front hip is moved toward the rear leg and the rear hip moves forward.

Hip Vibration:

Hip vibration could be described as a double hip rotation done on a smaller scale. The hip on the side of the technique is extended toward the technique, then immediately snapped back to its original position as the technique is focused.

Core Contraction:

Contraction of the core muscles of the hara results in moving the plane of the pelvis from its neutral, downward sloping angle to a more horizontal position, causing a straightening of the spine in the lumbar region. This has been described in martial arts literature in various ways; tucking the tailbone, pointing the naval upwards, and tilting the pelvis are just some of these descriptors.

Advice on the timing of this contraction also varies between senior instructors. Some would suggest that this position should be held consistently, while others advocate contracting the core at the moment of kime, then resuming a more neutral position. Some have no advice on the matter.

Qigong practitioners use core contraction during Nei Dan (internal) Qigong as a means of building qi (ki) in the seika tanden before moving this energy through pathways in the body for either health or martial application. Tai Chi literature likens the core muscles to a blacksmith's bellows which stoke the fires of qi in the seika tanden.

If we view progression in external martial arts as a path moving from the reliance on skeloto-muscular contraction, through increased usage of body mechanics, to a more energetically based practice, core contraction may be the gateway through which we make this transition.

Three Relationships in Combinations:

Flow:

In combination techniques, the end of one technique is said to be the beginning of the next. In order to accomplish a seamless transition, we must understand the type of relationship that each technique has to the other and apply the proper body mechanics.

Flow occurs when both techniques are essentially moving in the same direction. Releasing the focus of the first technique allows us to perform the second technique along the same line of motion.

An example of this would be a reverse punch-front kick combination, where the front kick is launched immediately following the focus of the reverse punch; the energy for both techniques is flowing in the same direction.

Rebound:

Rebound describes two relationships; the relationship between the techniques in combination and also the relationship between the feet and the floor. In addition to being used to launch individual techniques, rebound uses the reaction of the first technique pushing into the floor to add power to or initiate the second technique and can utilize either the rear or front foot.

An example of rear foot rebound would be a front kick-reverse punch combination with the front kick returning to its original position as the reverse punch is launched. The reverse punch is focused at the moment that the kicking foot is planted on the floor. Here, rebound is used as a way to increase power to the punch, rather than to initiate the second technique.

An example of front foot rebound would be a back fist strike-reverse punch combination, shifting from straddle leg stance to front stance. This shows the concept being used to initiate the second technique instead of adding power to it. In making a back fist strike in a straddle leg stance, the weight is slightly shifted to the lead foot during focus. As the technique is withdrawn, the rebound of the front foot from the floor allows us to rapidly shift into a front stance and execute a reverse punch.

Recoil:

Recoil can be likened to the winding up and releasing of a coiled spring and can be used during hip rotation. This is a subtle concept that can be confusing to less advanced students and presupposes a full understanding of the relationship between shomen and hanmi. Premature emphasis on recoil may be detrimental to a student's progress.

The combination of nihon zuki, jab-reverse punch, can be used to demonstrate recoil. In the standard performance of nihon zuki, as the jab is extended, the hips are shifted from either a neutral hip position or shomen to hanmi, with the rear hip staying primarily relaxed until focus, when it is contracted with the rest of the appropriate muscles, then relaxed. It is then again contracted to initiate the hip rotation back to shomen, in order to perform the reverse punch.

This interim relaxation produces a momentary break between the two techniques, violating the maxim that the end of one technique is the beginning of the next. In order to avoid this break, subtle isometric tension can be generated in the rear hip during the transition from shomen to hanmi, loading the hip and allowing for a seamless shift from the first to the second technique as the hip rotation is reversed. Emphasis, here, is on the subtlety of this tension. Too much rear hip tension during the jab will weaken the first technique. Too little tension will maintain the break between the techniques.

Individual body mechanics are not used in isolation but in combination; creating a synergistic effect on technique.

Greater insight into the nature of each individual technique will allow us to better understand where these body mechanics can best be applied.

Conclusion:

The purpose of this article is not to provide specific prescriptions for improvement but to offer a slightly different perspective on training that may stimulate new avenues of inquiry. A multidisciplinary inquiry is already happening in the area of kata bunkai, where researchers are looking toward other martial arts to provide insights into possible meanings of movements in kata. Similar research may provide us with a greater understanding of basic movement dynamics and how they can be applied to karate kihon. The caution, however, is to continue to build on the strong foundation that we have inherited and not to move in directions that are inconsistent with our core physiological principles.

Biography:

Bob Remington holds a Master of Science in Education from Johns Hopkins University and a 7th Dan in the Maryland Shotokan Karate-Do Association (MSKA). He is in fellowship with the International Shotokan-Ryu Karate-Do Shihankai (ISKS) and is affiliated with the International Society of Okinawan /Japanese Karate-Do (ISOK). Bob trains in and teaches Shotokan Karate-Do in Baltimore, MD, USA and can be reached at This email address is being protected from spambots. You need JavaScript enabled to view it.