

The Biomechanics of the Wauke

By Justin Testa; March 2024

Martial arts, with its diverse styles, incorporate many circular and curvilinear movements in both offensive and defensive strategies. Generating power in a movement that involves rotating your arm 360 degrees in front of you requires a combination of proper technique, body mechanics, and muscular engagement. In the previous section we described and illustrated the various principles in physics involved with executing an effective Sanchin arm thrust and reverse punch. The wauke, like the arm thrust, is a coordinated sequence of movements involving the entire kinetic chain of the body. The legs generate the initial force downward to gain kinetic energy that works back up through the legs and through the core muscles to facilitate rotational force and connection to the upper body. The back, shoulder, and arm muscles contribute to the efficiency and impact of the wauke circular movement.

In this section we will look at the biomechanics of the circular and rotational motions involved with the wauke. Once again, the intent is to not hit you with mathematical formulas, but to highlight several principles that are involved with performing the circular motion of the wauke to enhance your understanding and execution of this challenging movement. Rotating an arm quickly in front of the body involves principles of torque, centripetal force, and angular momentum.

When rotating your arm in front of you, pivoting around your shoulder, several biomechanical factors come into play. Muscles in your shoulder, chest, and upper back are activated to initiate and control the movement. These muscles work together to stabilize the shoulder joint and generate the necessary force to rotate the arm. Ligaments surrounding the shoulder joint provide stability and help prevent excessive movement, while tendons connect muscles to bones and transmit the forces generated during the movement. As you rotate your arm, biomechanical forces such as torque and angular momentum are generated. Torque is produced by the muscles acting on the bones around the shoulder joint, causing rotational motion. Angular momentum refers to the rotational momentum of your arm as it moves around the pivot point, the

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shoulder joint. The sequence of arm, shoulder, torso, hips, and leg involvement are key to unleashing a powerful wauke intercepting movement.

Sequential rotation refers to a process or technique where elements are rotated one after another in a specific order or sequence to generate momentum which is transferred to your arm. Those of you who are golfers understand the importance in the sequence of movements comprising the backswing that lead to the proper sequencing of rotational elements in the downswing motion, all leading to increased clubhead speed. Although the elements of executing an effective wauke intercepting movement differ from a golf swing, the principles are similar.

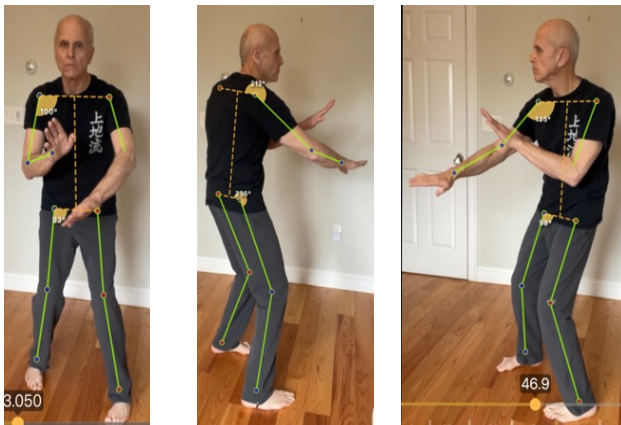
Torque is the rotational equivalent of force and initiates circular and rotational movements. In the case of the wauke, torque is the force that enables you to initiate the rotation of the arm in a circular way. is the force that causes an arm to rotate around the shoulder (axis), initiating circular motion. Once the arm is in motion, centripetal force acts as the inward force to keep it moving in a circular path. It is the muscles of the shoulder and upper body that provide the “inward” force to maintain the circular motion. The faster you rotate your arm, more centripetal force is required. Going back to the golf swing analogy, torque generated by the golfer’s muscles initiates the rotational motion of the club, and centripetal force keeps the club moving along its circular path as it swings through the downswing.

When you rotate your arm, you generate angular momentum. We learned in the section on the Sanchin arm thrust, the higher the momentum, the greater the impact force of the thrust. Angular momentum is the rotational equivalent of linear momentum and considers the mass, angular velocity, and the distance from the center of rotation of the object. So the greater the angular momentum of the arm, the greater the impact of the wauke as an intercepting movement. When performing the wauke, the distribution of angular momentum varies along the arm. For purposes of practicality, let’s consider the arm consisting of two major segments – the hand/forearm and the upper arm. Since

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the hand/forearm is farther from the shoulder than the upper arm, it has a greater angular velocity due to it being the greatest distance from the center of rotation, the shoulder, and therefore greater angular momentum. This understanding can help in understanding the practical applications of the wauke intercepting movement.



Initiate the wauke movement by moving both arms to centerline, rotating your shoulder, arm, and hips in the direction of the arm rotation. Simultaneously the other shoulder is rotating back, along with the hips, and a shift of weight goes to the rear leg.

Torque, the rotational equivalent of force.

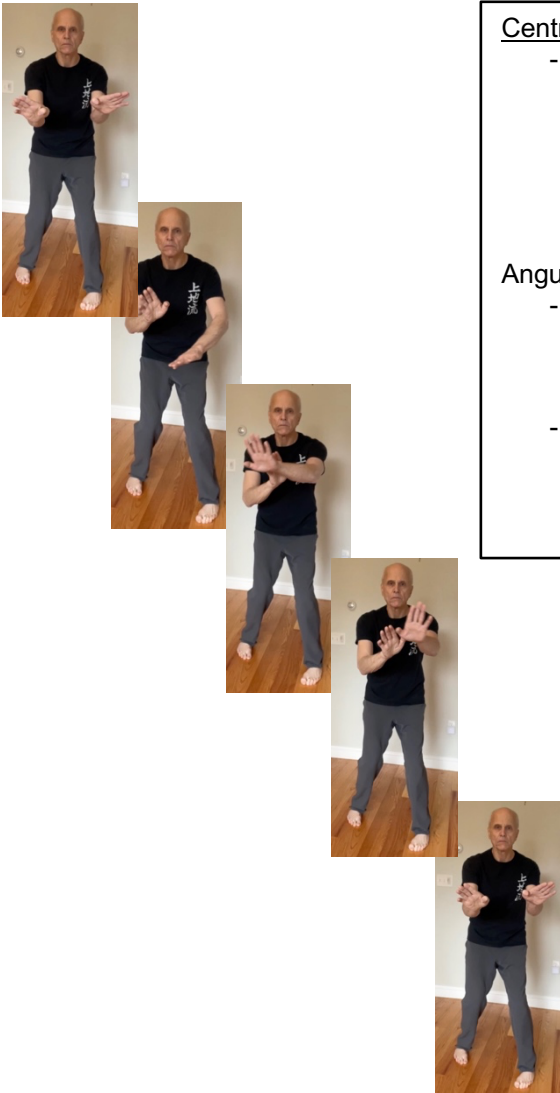
- The muscles of the arm, chest, shoulders, core, and legs provide torque, the “force” to initiate the motion of the body as the wauke is initiated.

Sequential Rotation:

- The order of the sequence of arm, shoulder, torso, hips, and legs involvement are key to unleashing a powerful wauke motion.
- As the shoulder of the intercepting arm moves forward and the opposite shoulder moves back along with the hips, the weight shifts to the rear leg. A downward force is exerted to the ground using the levers and muscles of the legs, ankles, and feet. A corresponding force from the ground initiates the kinetic chain motion from the ground (Newton’s Third Law).

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Centripetal Force:

- When executing a wauke, the karteka applies force using various muscles towards the center of rotation, which in this case is the shoulder joint. This keeps the arm moving in a circular fashion.

Angular Momentum;

- Overall, the distribution of angular momentum along the arm is influenced by various factors including mass and distance from the axis of rotation.
- Since the hand/forearm segment is farther from the shoulder joint than the elbow, it will have a greater angular velocity due to its larger radius

GEMtip – Wauke Hand Position

The palm of the hand is facing down as the motion is initiated and faces out as the circular motion is performed. This results in the ulna section of the forearm exposed.

Some perform the downward motion with the palm up to get a twisting motion of the forearm as the wauke finishes. However, this exposes the soft part of the forearm and upper arm, where there are many blood vessels and nerves that could easily be cut or struck.

I prefer to be intercepting whatever is coming at me with the edge of the arm, forearm, and the top of the arm because you're lifting, pushing out, and finishing with the strong part of the forearm.

Overall, the biomechanics of rotating your arm in front of you as you perform a wauke involve the coordinated activation of muscles, movement of joints, transmission of forces through the kinetic chain, and the generation of rotational motion through torque and angular momentum. By understanding the biomechanical movements involved with the wauke and incorporating these principles into your practice, you can effectively generate an efficient and powerful wauke movement.

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Takeaways from these principles:

- *In executing a wauke circular intercepting movement, begin by engaging your core muscles and lower body to establish a stable base whether you are static or performing a stepping movement. This provides a strong foundation for generating power and transferring energy throughout the movement.*
- *Utilize good arm mechanics and apply force gradually. As you rotate your arm, focus on using your entire arm, including the shoulder, elbow, and wrist joints, in a coordinated manner. This allows for a fluid and continuous motion throughout the 360-degree rotation. Instead of exerting maximum force at the beginning of the movement, gradually increase the force as you rotate your arm. This allows you to build momentum and generate power more efficiently. You do not want to “windshield wiper” the movement around the elbow joint.*
- *Engage the muscles of your arm, particularly the deltoids, rotator cuff muscles, biceps, and triceps, to generate force throughout the rotation. Focus on relaxing in these muscles in the manner of the Old Way and accelerating in order to maximize intercept power at the point of kime.*
- *Generate greater angular momentum. The distribution of angular momentum is often greatest in the segments closest to the axis of rotation. This understanding can help in understanding the practical applications of the wauke intercepting movement.*
- *Emphasize acceleration, speed, and precision in your movement to optimize power generation. Aim to complete the rotation smoothly and quickly, while maintaining control and accuracy. Accelerate no matter the speed.*
- *Ensure a complete follow-through of the movement, allowing your arm to finish at either guard or at the hip on the case of a Sanchin wauke movement. The finish of the wauke is the “control” aspect of the motion.*

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I recommend these drills for karateka with a minimum rank of Gokyu (green belt). Before this rank, attention should be given to performing the movements with accuracy.

Drill #1: “Flinch Action” Wauke

Practicing movements from a neutral position (vs. guard), is a good way to discover new interpretations of movements and to develop flinch actions for self-defense. We will explain flinch action in more detail later in the book.



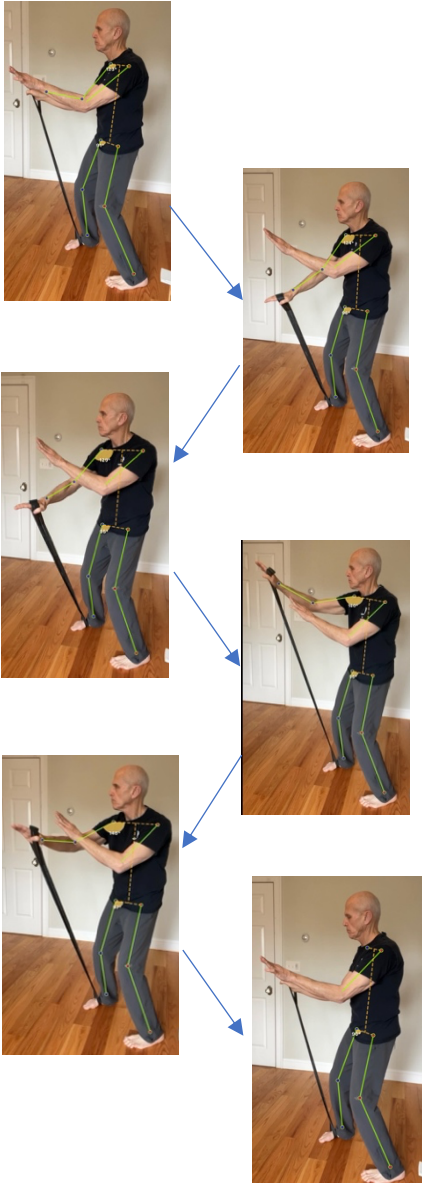
1. Stand in neutral stance with arms at your side; and relax.
2. Step out with either foot into a Sanchin stance. At the same time, initiate a wauke by moving both hands to the centerline, while leading out with the shoulder of the intercepting arm.
3. Feel every movement originating from the ground; engage your core and keep your center of balance over the center point of the feet.
4. Keep it slow as you coordinate the lower body with the upper.
5. Accelerate the movements, no matter the speed.
6. Be aware of the “spiraling” motion of the wauke while stepping in.
7. Finish the step and wauke at the same time.
8. Experiment by reducing the amount of circular motion and by the point of interception.
9. Kime at point of intercept.

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Drill #2: Resistance Exercise

Resistance bands are an excellent way of getting resistance training within the actual movements themselves. I prefer the TheraBand CLX looped bands because of the convenience of the loops and you can use Uechi-ryu hand formations. Use of resistance bands as supplemental exercise is covered in greater depth later in the book.



1. Practice body flow movement of the wauke using the resistance band with one loop around the forward foot and the other around your hand.
2. Create enough tension in the band so that there is no slack at your starting position, but not so much tension that you lose form of the wauke to move the band.
3. Start in a good Sanchin stance.
4. Sequence the movement of both arms, shoulder, hips to initiate the wauke.
5. Use the rear foot to drive down to initiate the movement and the energy through the legs.
6. Activate the core.
7. Only engage those muscles needed to perform the movement.
8. Alternate sets on each arm.
9. Practice this motion slowly, but with acceleration.
10. Breath correctly.
11. Over time you can increase the resistance of the band and/or the speed of the wauke.