Anterior and Posterior Serape: The Rotational Core

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ABSTRACT

THE PURPOSE OF THIS ARTICLE IS TO EXPAND A CONCEPT SURROUNDING THE ROTATIONAL FUNCTION AND TRAINING OF THE BODY'S CORE. MORE THAN A DECADE AGO, A MODEL WAS PROVIDED BY WHICH TO OBSERVE AND TRAIN THE CORE, WHICH WAS BASED ON A PREVIOUSLY PUBLISHED THEORY REGARDING THE SERAPE EFFECT. THE PURPOSE OF THIS ARTICLE IS TO EXPAND ON THAT MODEL, THE ORIGINAL SERAPE EFFECT, AND TO PROVIDE A MORE COMPLETE MODEL FOR ANALYSIS AND TRAINING OF THE BODY'S CORE.

INTRODUCTION

The core of the body has been the topic of much discussion and debate over the past few decades. Researchers and therapists have postulated various theories on the function of the core and various ways to train. Some groups theorized the importance of single muscles in stabilizing the spine for pain control such as the transverse abdominis (TVA) (5,6) and psoas for walking and lifting patterns (4). Subsequently, some clinicians and educators promoted specific core-training methods, such as the "drawing-in" maneuver and the activation of the TVA muscle. While these were controversial, a broad discussion of the appropriateness and efficacy of these approaches is contained in McGill (11). Others have addressed issues pertaining to training the core in a variety of ways, using unstable surfaces being 1 example (1), to broader ground-based approaches to training (15). The purpose of this article is to consider the core in a broader functional sense in the context of rotational movement and torque production.

Given that the "core" has been the topic of much discussion and debate over the past few decades, we begin with a definition of where the core stops and where it starts. For the purpose of this article, we will consider the core in 2 parts. First, the torso between the ball and socket joints of the shoulders and hips forms what is thought of traditionally as the core. The muscles that attach the pelvis, spine, and ribcage perform many functions but for this first level of discussion are generally responsible to stop motion. The second part of the core enhances function with muscles that cross the shoulders and hips to the upper and lower limbs. Because of its size and capacity to become rigid, the core serves as an anchor of sorts for the limbs–especially the upper extremities. In most athletic situations, the hip musculature generates the majority of power (2,7,12). The power is transferred upward through the linkage to the arms through a "stiffened" core (2,7,12). Stiffness is the essential precursor to stability and the efficient transfer of forces, together with being one of the keys to injury prevention (Myers (13) summarizes several studies that integrate these concepts together with quantification of stability). McGill (10,12) presented 4 basic principles of spinal stability that may direct purposeful training, enhance performance, and help prevent a host of injuries related to instability: (a) proximal stiffness (meaning the lumbar spine and core) enhances distal segment athleticism and limb speed; (b) a muscular guy wire system is essential for the flexible spine to successfully bear load; (c) muscular coactivation creates stiffness to eliminate micromovements in the joints that lead to pain and tissue degeneration; and (d) abdominal armor is necessary for some occupational, combative, and impact athletes. The serape (8) involves these features from both ends of the core in a spiral pattern.

How does core stiffness enhance limb speed and strength? Consider an example with a basic athletic movement, throwing (Figure 1). A right-handed pitcher "winds up" the throw bringing the left leg up and balancing on the right leg,

KEY WORDS:
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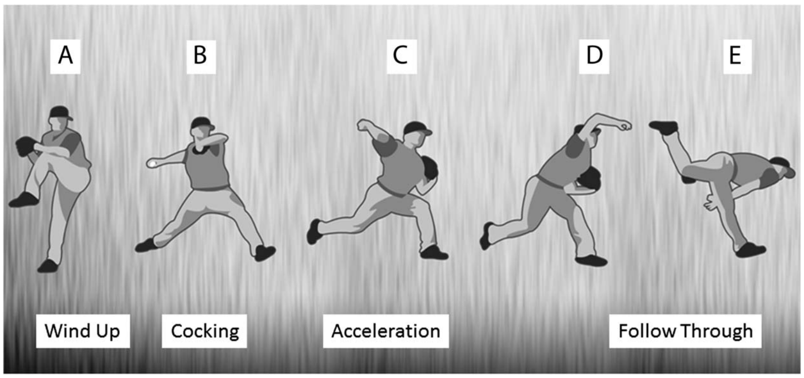

Figure 1. Notice that there is little "twisting" of the core during the entire pitching motion beginning at wind up; the core is actually "stiffened" during the cocking and acceleration phases. This stiffening allows the serape muscle and other tissues to transfer the serape's "hip power" to the shoulders and eventually the hand all the way to the follow through.

slightly flexing the right hip and knee. This position loads the posterior serape (i.e., posterior diagonal musculature from right foot to left shoulder) (Figure 1A). The pitcher strides to begin the "cocking phase" using the posterior serape to generate the forward momentum of the core–this forward movement sets up the early cocking phase of the throw. During the early cocking phase (Figure 1B), the anterior serape (i.e., anterior diagonal musculature from right arm to left foot) is loaded, as the right arm and left leg are extended and abducted. During the "late" cocking phase, the left foot is planted into the ground to decelerate the left hip's forward momentum, whereas the right hip continues its forward movement. This foot plant also loads the elastic component of the linkage to store some elastic energy. The counterclockwise hip rotation of the cocking phase (Figure 1C) sets up the "acceleration" phase to unleash the stored energy. The key to the acceleration phase is a stiff core so that maximum power can be transferred between the hips and the shoulders. However, the core stiffness is tuned with the appropriate muscle activity to best enhance the storage and recovery of elastic energy similar to an elastic band. Using the anterior serape (i.e., right shoulder to left hip), the core's bigger mass "pulls" on the lighter right arm of the pitcher, much like a hand pulls on a whip. Hip rotation is accelerated in a counterclockwise direction by the extension of the left leg (i.e., driving the left hip back) as the right hip continues its forward trajectory (Figure 1D). The acceleration phase is complete as the ball is released and the "follow through" phase begins (Figure 1E). The follow through phase is decelerated by the posterior serape that goes from the left gastrocnemius muscle to the right latissimus.

Thus, the muscles create force and tuned stiffness. This "tuning" in essence allows active muscle forces to work with the elastic recoil of other tissues (e.g., ligament, tendons, and fascia). The muscles of the shoulders, hips, and limbs are generating forces to create the motion in a pulsed sequence. The core is creating a stiffened anchor (proximal stiffness) to unleash this distal athleticism. During the cocking and acceleration phases, the great athletes are better able to "tune" the stiffness of the core musculature to optimize the serape's whip (Figure 1).

The architecture of the serape is the key. By creating a stiffened core in a spiral pattern, the proximal ends of the hip and shoulder muscles are anchored producing faster arm and leg motion across the body. This is an essential component for all rapid reciprocal motion, such as running (particularly sprinting), throwing, kicking, changing direction, stair climbing, chopping firewood, and even single-sided lifting and carrying. Thus, a universal law of human movement is

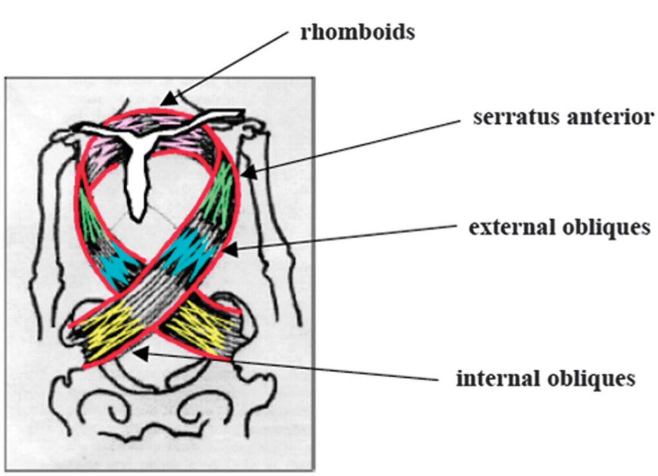

Figure 2. Logan and McKinney's (8) original serape looks like a giant scarf wrapped around the back of the neck, crosses the front of the body, and tucks into the pant line.

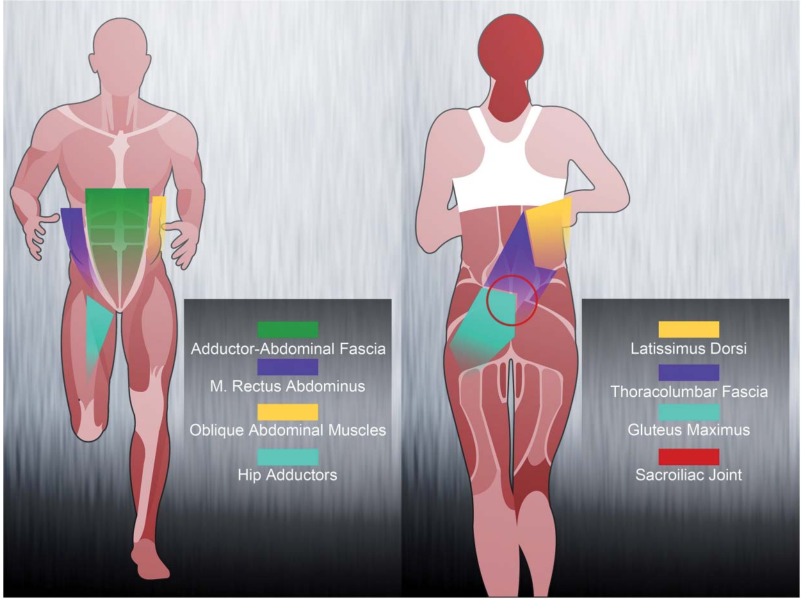

Figure 3. The anterior and posterior oblique systems popularized by the physical therapy profession.

established—"proximal stiffness enhances distal mobility and athleticism" (12). This requires core stiffness enhanced by the serape.

Creating rotational power in the torso section of the core is problematic for enhancing performance while improving injury prevention. Power is the product of force multiplied by velocity, or in a rotational sense, twist velocity multiplied by twisting torque. One of these must be low if the other is high. For example, in the golf swing, the twist velocity is high, but the rotational force is low resulting in low power, and low risk. If the twist force is high, then the speed must be low. This same concept holds true for pitching in baseball—observe the motion at the hips and shoulders as there is very little torso twisting. However, if the rotational force is high, then the twisting velocity must be low to keep the torso power low. The implications for training are to stiffen the torso and focus the twist motion about the hips and shoulders. Consider exercises, such as the Paloff press, birddogs, short cable/band rotations, one-arm push-ups, and one-arm standing cable presses—all of these are designed to enhance performance of the serape with minimal risk. For example, a staggered stance (left foot forward), contralateral-arm, band or cable press, involves the diagonal core musculature consisting of the right serratus anterior, the right external obliques, left internal obliques, and the left hip flexor/adductor complex (15–17).

Various functions, such as swinging a bat, use gravity to passively load the various systems of the body, together with active muscle force increasing and directing ground reaction forces to turn the hips, a "stiffening" of the core to connect the hips to the shoulders and produce rotation, the upper extremities then transfer the rotational power to the bat. This rotational power is a common theme throughout many of the body's most celebrated and used functions, from swinging implements to running. The original serape effect presented by Logan and McKinney (8) provides some insight into the force-generation patterns used by the body to transfer forces across the core. However, Logan and McKinney clearly indicate that

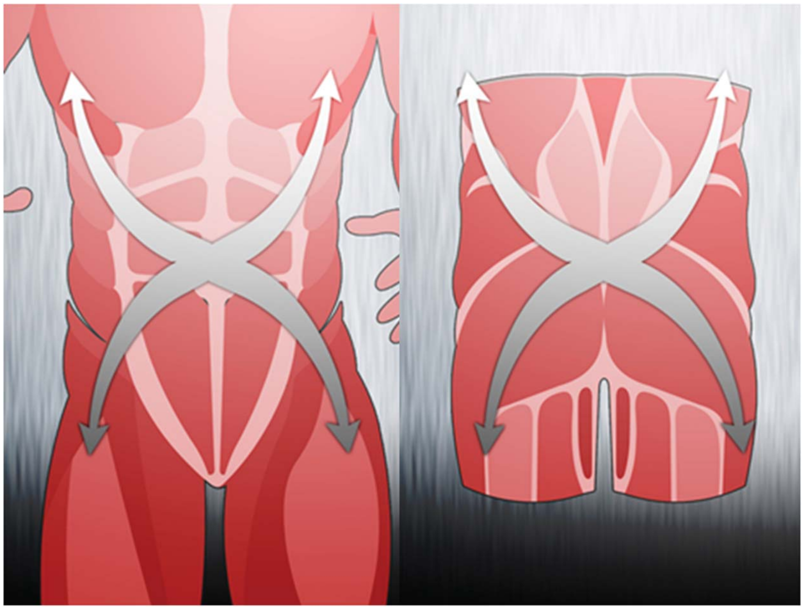

Figure 4. Vleeming's (17) work on the anterior and posterior oblique sling system clearly provides an insight as to how forces cross the pelvic junction in front and behind the body.

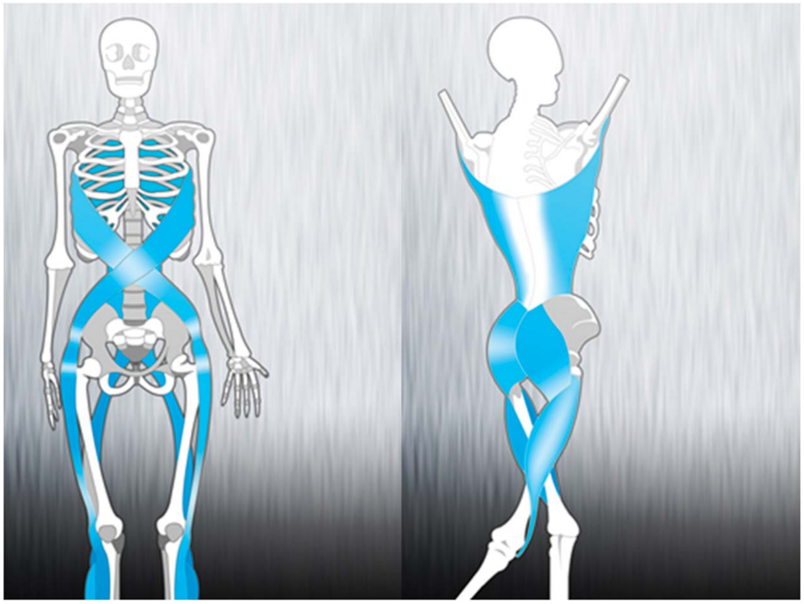

Figure 5. The serape involves muscles arranged in series fashion along spiraling lines with myofascial connections between the muscles and their tendons. Many of these muscles and tendons do not connect directly to bone, rather they connect to one another transmitting force along pathways ranging much further than simply the length of any 1 muscle.

their serape effect is only part of a multisystem model and it is this multisystem model this article will present.

Logan and McKinney's original serape looks like a giant scarf wrapped around the back of the neck, crosses the front of the body, and tucks into the pant line (Figure 2). This model provides graphic insight into the spiral nature of the body's core, more specifically, the diagonal nature of the anterior accelerators.

Introductory anatomy courses usually describe the anterior and posterior oblique systems (Figure 3). In 10 years of investigation and countless communication with core/spine experts, such as Vleeming (17,18), Myers (13,14), and others, we have not been able to ascertain the origins or source of the anterior and posterior oblique system. However, the origin of the oblique system may be traced to the early 1900s, and the work of Lovett (9), and Dart (3) who introduced the concept of a spiraling movement system governed by muscle and joint actions (3). In the mid 1900s, Voss et al (19) also mention the oblique system and the pivot points, referring to them as "patterns of facilitation."

Regardless of the origin of the anterior and posterior oblique muscle systems, Vleeming's (17) work on the anterior and posterior oblique sling system clearly provides an insight as to how forces cross the pelvic junction in front and behind the body (Figure 4).

What is clear from the anatomical description of the serape is that the involved muscles are arranged in series fashion along spiraling lines. Myers (13) describes the myofascial connections between these muscles and their tendons. Many of these muscles and tendons do not connect directly to bone, rather they connect to one another transmitting force along pathways ranging much further than simply the length of any one muscle (Figure 5). However, to transmit force along the serape, muscle pairings emerge. For example, according to the posterior oblique model, the right gluteal muscles would pair with the left latissimus dorsi.

The anterior and posterior serape (APS) is a concept to explain the

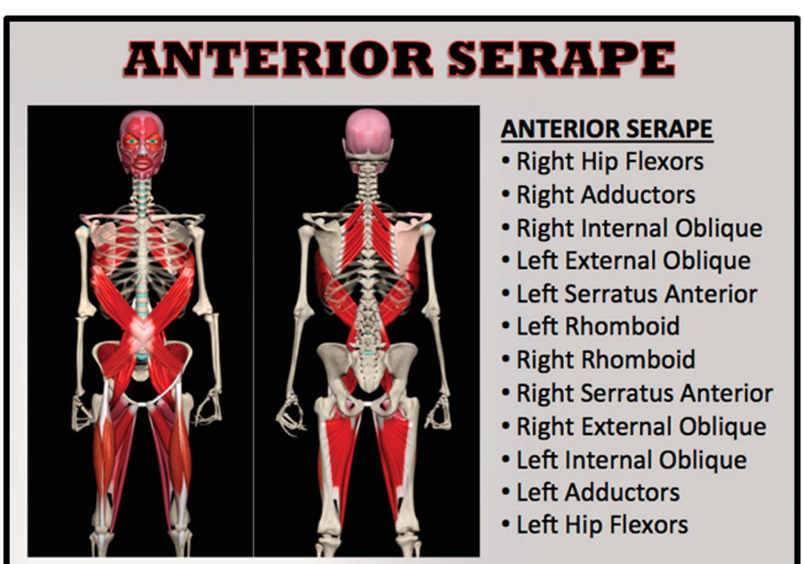

Figure 6. The anterior serape looks like a ribbon wrapped around the back and crossed in the front of the body, illustrating the body's ability to function as a bow using the anterior core musculature.

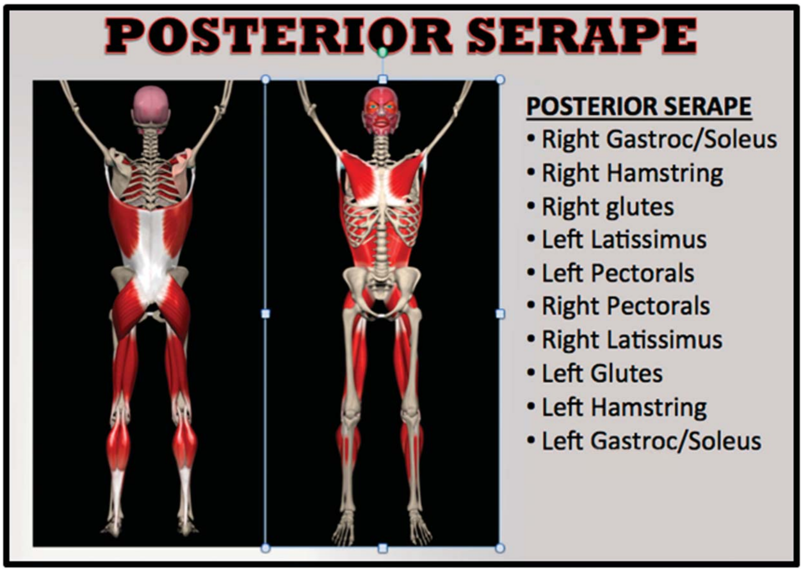

Figure 7. The posterior serape looks like a ribbon wrapped around the front and crossed behind the body, illustrating the body's ability to function as a bow using the posterior core musculature.

total body routing of power in human movement (Figures 6 and 7). This model expands the original serape spiral concept to include the upper and lower body on both sides. The diagonal ribbon crosses the upper body anteriorly through the pectorals and posteriorly through the rhomboids.

The APS model can provide a practitioner with an easy method to follow the force-generation patterns the body uses to perform just about any activity, from running to throwing a ball, to picking up a barbell (e.g., deadlift). The batting motion is used to illustrate how the body works with the APS (Figure 8).

A left-handed batter will load up the back swing on his left leg, while rotating his shoulders to the left. This loads up the posterior serape active musculature and related passive fascia from the left leg to the right shoulder:

- Left gastrocnemius/soleus.
- Left hamstring.
- Left gluteals and hip abductors.
- Right latissimus.

As the posterior serape fires from lower left to upper right, it loads the anterior serape from lower right to upper left, loading the following:

- Right hip flexors.
- Right adductors.
- Right internal oblique.
- Left external oblique.
- Left serratus anterior.

Once the above-mentioned APS muscles (and related fascia) complete the contact phase, the opposite APS muscles decelerate the swing, using the following muscles (and related fascia):

Posterior serape:

- Right gastrocnemius/soleus.
- Right hamstring.
- Right gluteals.
- Left latissimus.

Anterior serape:

- Left hip flexors.
- Left adductors.
- Left internal oblique.

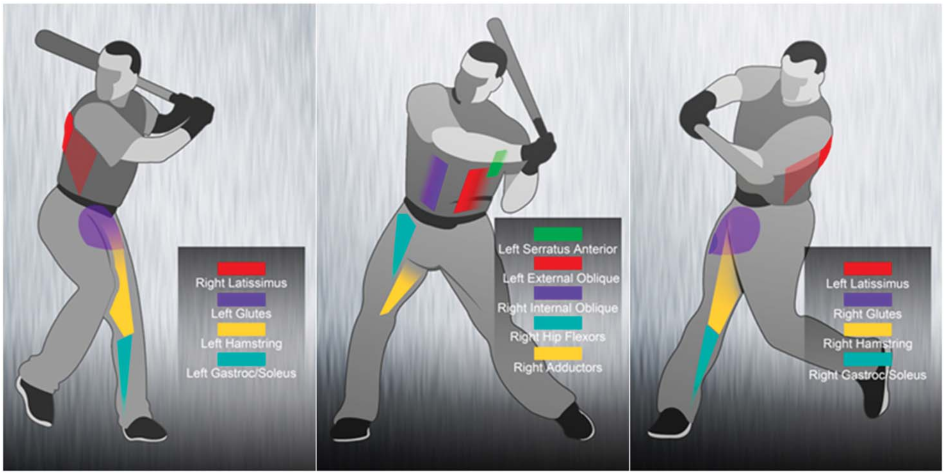

Figure 8. A left-handed batter will load up the backswing on his left leg, while rotating his shoulders to the left. This loads up the posterior serape musculature from the left leg to the right shoulder. As the posterior serape fires from lower left to upper right, it loads the anterior serape from lower right to upper left. Once the anterior serape completes the contact phase, the opposite posterior serape decelerates the swing.

- Right external oblique.
- Right serratus anterior.

The interplay of these diagonal patterns of muscular contractions provides the rotational power we see in many sports and functional activities, such as running, golfing, kicking, and changes in direction. Even what seem to be vertical activities, such as getting up out of a chair, throwing a soccer ball overhead, vertical jumping, piking during a dive, and deadlifting a bar, use the APS. During vertical activities such as these, both diagonal patterns of the APS are synchronously coordinated, so there is no net rotation when both sides of the torso and legs produce force, in essence creating what McGill (12) refers to as a "super stiff" core. If all of the muscles of the anterior serape simultaneously contract, activities such as throwing a soccer ball or performing a pike-tuck in diving become possible. Conversely, if all of the muscles of the posterior serape simultaneously contract, deadlifting a bar or performing a vertical jump is enabled.

CONCLUSIONS

The APS system unifies an understanding of how the body organizes the many parts of the body linkage to create rotational activity. Muscles of the serape form a spiraling system, augmented with elastic passive tissues such as fascia that enhances the efficiency of cyclic activity such as walking, together with power and speed activities such as throwing and golf. The stiffened core enables power produced distal and beyond the ball and socket joints to transmit to the ball and socket joint at the other end of the core forming a whip. While this article served to form a foundation of defining and describing the serape or rotational core, a companion article suggests several techniques to enhance athletic performance taking advantage of the APS.

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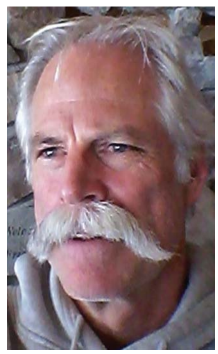

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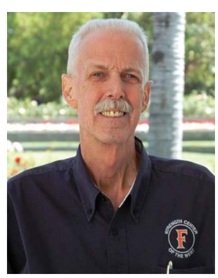

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