

Tensegrity and Asana

Perfection in an asana is achieved when the effort to perform it becomes effortless and the infinite being within is reached.

Yoga Sutras of Patanjali II: 47
Translation, BKS Iyengar

The “effortless effort” of perfect pose that is described by Patanjali can be equated to the maximum efficiency of a *tensegrity*¹ structure. In such structures strength and stability are achieved through balanced tension and compression forces with discontinuous compression elements pushing on a continuous network of tensile elements. The air molecules in a balloon, for example, push outwards on the inside of the balloon while the skin of the balloon pulls continuously inwards on the air inside. When the pull of tension elements is balanced against the push of compression elements we have a true tensegrity structure, whether architectural, mechanical or living, which offers the maximum amount of strength for a given amount of material.

In the body, the muscles and fascia, or myofascia, are the tension elements pulling on the bones. The bones are compression elements that hold the myofascia in their tensile web. Most babies sit and move with true tensegrity quality. Even doing something as simple as sitting on the floor, a baby exhibits a relaxed, rooted connection with the earth and a light, upright spine. There is no extra tension in her body, but a natural ease that allows her to lean toward the floor to grasp an object. This easy grace is often lost as we grow into adulthood. Injury, repetitive movements and unreleased physical, mental and emotional stress are stored in our myofascia, which become overlong or overshort, no longer providing balanced tension on the bones. The body loses its ability to operate with maximum efficiency. It takes more energy to move or hold a position, the bones get pushed out of place and the natural tensegrity quality of the body is lost. In short, to experience the effortless effort describe by Patanjali, we must learn to balance the tension provided by the body’s web of muscles and fascia.

In Vijnana Yoga, we practice Seven Vital Principles* in order to cultivate inner awareness and access the higher self. Patanjali’s perfect pose, with still mind and open heart, is thus experienced. In her explorations of the Seven Vital Principles, Gioia Irwin has found that the myofascial meridians identified and defined by Thomas Myers in his book

Anatomy Trains,² are physical manifestations of the energy lines experienced as we practice the Vijnana principles of rooting and connecting. The anatomy trains are continuous tracts of muscle and connective tissue – sometimes broad sheets and sometimes narrow lines – that are key tension elements in the body. As we learn to bring balance to these lines, we find ourselves experiencing more and more tensegrity in the body: the bones of the body find their place at the center of the flesh; there is space rather than compression at the joints; there is strength without strain; the negative spaces of the body are drawn up into natural arches, domes and pits; and the body feels buoyant and resilient. This tensegrity quality brings stability, ease and grace in body and mind.

To apply this theory to our understanding of yoga postures, imagine a simple triangle posture. In perfect pose we see: feet balanced, broad and firmly grounded; legs steady and stable; hips naturally aligned; spine elongated; chest broad; arms reaching outwards; and head and neck effortlessly aligned. We see stillness, expansion, ease and grace: the maximum efficiency of a tensegrity structure. On the other hand, imagine *trikonasana* with the hip jutting out; torso curved forward, upper arm flung back and neck turned and hyper-extended. We will likely also see strain and struggle in the feet and tension in the face and shoulders. The myofascial meridians are not maintaining continuous lines of tension in this second example. The myofascia at the front and the back of the upper shoulder, for example, are not balanced: the myofascia at the front of the shoulder joint are over-stretched and the back of the shoulder joint is compressed, allowing the bones to press forward into the flesh.

Bringing tensegrity to the body has multiple benefits.

- There is no excess tension in the body.
- Energy is not wasted when we stand or move.
- Individual muscles and bones are not overtaxed since force is distributed throughout the system.
- We do not fight gravity but align with the *rebound force*³ of the earth, replacing heaviness with lightness and ease.

- Our bones are effortlessly held in the center of the flesh, bringing natural alignment to the body.
- There is space at the joints so they are not torqued, compressed or strained and we are able to avoid injury.
- There is a sense of buoyancy and play in a posture, since the joints are both stable and mobile.
- The spring and energy that is inherent in a tensegrity structure helps us jump in sun salutations and roll up to a stand from a back bend or step the feet up into a handstand.
- The negative spaces of the body are drawn up and into the body: The arches of the feet are lifted. The pits of the arms, legs (femoral triangles), elbows, knees, neck and throat are drawn into the body, and the pelvic floor, diaphragm, and the fascia of the roof of the mouth and skull form supportive domes.
- We are able to balance in different orientations, such as upright (standing poses), upside-down (headstand, handstand and forearm balance), and sideways (half moon pose).
- The body has an expansive quality that allows energy to flow freely and the organs to operate effectively. At first we might notice that it is easier to breathe when the chest is broad rather than collapsed. With practice, we experience the flow of energy or prana within the energy sheath (pranamaya kosha).
- The ease and evenness of tone in the myofascial system influences the neurological system, helping to quiet the mind.
- We experience Patanjali's perfect pose: effort becomes effortless, mind is stilled and consciousness moves inward to unite with its source.

Notes

1. **Tensegrity** is a portmanteau of **tensional integrity**. It refers to the integrity of structures as being based in a synergy between balanced tension and compression components.

Tensegrity is the exhibited strength that results “when push and pull have a win-win relationship with each other.” Tension is continuous and compression discontinuous, such that continuous pull is balanced by equivalently discontinuous pushing forces. Buckminster Fuller explained that these fundamental phenomena were not opposites, but complements that could always be found together. Tensegrity is the name for a synergy between a co-existing pairs of fundamental physical laws; of push and pull, and compression and tension, or repulsion and attraction.

<http://en.wikipedia.org/wiki/Tensegrity>

2. **Anatomy Trains**, Thomas Myers, Churchill Livingstone, 2001.

<http://www.anatomytrains.com>

3. **Rebound Force**

Newton's third law states that every action has an equal and opposite reaction. The rebound force of the earth on the body is the equal and opposite force that is exerted upon the earth by that body. In physics it is called the Normal Force.