

Protection of Joints and Connective Tissue in Taijiquan

by Rick Barrett (Article first appeared in Tai Chi Magazine, summer 2001)

Most taijiquan practitioners are too strong for their joints. This is an observation rather than a scientific fact, but one that bears some examination. The number of taiji people with painful and injured joints seems surprisingly high for a martial art that professes to heal these things. I don't have statistics to back up this point, but I am guessing that the reader knows one or more in this category. Players with knee, shoulder, elbow, finger problems seem to be rather commonplace and I am guessing there are many more who don't reveal their injuries.

A key element of taijiquan training is observing Nature. What better place to start than your own body

Simply put, joints have a preferred direction to their movement, as well as an optimal range of motion. Hinge joints, such as knees and most finger and toe joints, operate along one axis. Pushed too far to the back or side and they complain. A saddle joint like the base of the thumb can operate on two perpendicular axes, giving a wider range of motion.

Hips and shoulders are ball and socket joints that rotate quite nicely within their easily determined range. Connective tissues, such as ligaments, tendons, fascia, cartilage, act to support joints in the execution of their mission. Connective tissue is a continuous living matrix that unites each cell in the body in an intelligent energetic web.

Something less commonly known is that joints have an optimal power zone. Exceed that zone and the load no longer transfers smoothly through the joint, but begins to strain the connective tissue supporting it. Sprains, strains, tendonitis, tears, etc. result.

Golgi Tendon Organ.

In normally developed musculature, one can easily find joint positions where the load he tries to lift exceeds the ability of the joint to do so safely. The nervous system of the body has a mechanism called the Golgi tendon organ that is designed to calibrate the load that the connective tissue will support safely. It actually measures precisely the net amount of force being delivered by a muscle. (See JOB'S BODY by Deane Juhan)

There are muscles in the body that have the power to uproot the tendons right off the bone. The Golgis report directly to the spinal cord and give a signal to the

muscle to relax if the tendon is pulled on too hard. This signal is felt as pain if the early messages are ignored.

The higher centers of the brain can shape and even override the Golgi response. Any activity where we learn to sense precise effort, from taijiquan to tying a knot, involves a dance between our conscious mind and this primal reflex. Danger arises when we use our consciousness to ignore the signals and "push through the pain", causing the connective tissue supporting the joints to stretched to the point of injury.

Learning the hard way.

Years ago, I learned this the hard way. Training push hands, I would get lost in the thrill of playing and push with my shoulder in a disadvantageous position. Being a slow learner, I did this again and again over a period of 3 years. Sometimes my rotator cuff would be so injured I couldn't lift my arm without severe pain. (Interestingly enough, I could always push through the pain if I had to. I told you- slow learner!) Eventually, I tired of this game and slowed things down enough to discover that there were positions where my muscles were too strong for my joints. From that I was able to develop an exercise program to rehabilitate the shoulder completely. A more important lesson was learning to listen to my body.

It seems like one of those "everyone knows that" ideas until you look around you. Go to a gym and watch professional trainers encourage clients to bring heavy weights down to their chests for a bench press, straining elbow and shoulder joints. Watch as a taiji student ignores the knee pain and tries to emulate a teacher by going way too low on one leg. The teacher through years of practice may have developed the tissue to support such a move, but the student sees only the external form and tries to copy that. A push hands player tries to push with collapsed elbow and shoulder and concludes he has "no power" when his efforts are fruitless. Or worse, he pushes through his body's best efforts to warn him and suffers a serious shoulder or elbow injury.

Range of Power.

So what are the optimal ranges for expressing force through the joints?

Naturally, one has to experiment with this idea and find his own answers. It's not really an intellectual concept; it is a felt sense. Once consciously aware of it, one can then calibrate how much work he can do in what position. I can lift a piece of paper with my arm in any position, but I have to make some serious adjustments to pick up a bag of cement.

Demonstration: A simple demonstration of this principle is to stand facing a wall an arm length away. Very slowly lower yourself toward the wall, supported by one arm.

Notice that it is relatively easy to support your body weight with your arm extended (Photo 1) but becomes progressively harder as you approach a 90 degree bend in your elbow. The connective tissue around shoulder and elbow start to tense and protest. Go past 90 (Photo 2) and you are weakened substantially. Reverse it and notice that once past 90 degrees it requires less effort again.

Demonstration: Test the knee. Supported by a hand on a wall or railing, slowly lower yourself on one leg and make similar observations. Notice the narrow range where the leg is strong (Photo 3). Notice where the knee begins to protest (Photo 4). Notice where you enter the area of pain.

Extraordinary athletes.

The fact that we CAN override the pain and push our bodies to extremes doesn't mean we should. Dr. Jay Dunbar, in a presentation on knee safety, made a very good point: In such studies as martial arts, very often those who are selected as teachers are those of exceptional physical gifts who can do extraordinary things with their bodies. In our desire to emulate the extraordinary abilities, we often ask our bodies to exceed our own personal limits. In martial training, it is important to differentiate between the essence of the art being taught and the idiosyncrasies of the individual teacher, no matter how gifted.

Taijiquan is nothing if not a vehicle of exploration of the relationship of our bodies to the world around us. If we learn nothing else from our study, the ability to move more relaxedly and efficiently is reward enough. Sometimes pain and injury can be a very effective teacher.

The Relaxation Problem.

We are all exhorted by our taiji teachers to relax and not strain with our muscles. Most of us can do this well enough until we encounter some resistance that should yield to our efforts- but doesn't. Anyone can use "four ounces" while doing a solo form, but it is when one encounters "a thousand pounds" that we are tested. Too often I have seen players with decades of taiji experience discard everything they "knew" when facing a serious challenge.

The flaws in our structure become magnified when the "Ward Off with Left Hand" we have practiced diligently for YEARS can be collapsed by a single finger's worth of resistance. What good is a Ward Off that can't ward off?

Strictly from a biomechanical view (I'll save the energetic implications for another article), the warding arm is too collapsed if the angle of the elbow is less than 90 degrees (Photos 5 & 6). With even a little pressure, the connective tissue becomes stretched past the comfort zone signaling the muscles to let go, rendering the Ward Off ineffective. The surface appearance is that it "didn't work", causing the player to question the validity of this "internal stuff". We reactively shed this "woo-woo" stuff and go back to what we've always done (usually involving excess muscular tension).

In such situations, the relaxation was replaced by tension because at the deepest levels of our body/mind we don't really believe we are safe or powerful without muscular tension. It is an ancient reflex that probably has its roots somewhere in our dark quadrapedal past, when such vigilance meant eat or be eaten. All the reminders to relax programmed into our conscious minds are unavailable when the "Reptile Brain" is activated.

Reptile Brain.

In one model of brain evolution, it is seen as developing in three distinct stages, with each stage transcending and including the one before. The three stages are Reptile Brain, Paleo-mammalian Brain (limbic system), and Primate Brain. Space here does not permit a full development of this topic, so I will restrict my comments to the earliest stage.

The Reptile Brain is composed of the pons, medulla oblongata, and midbrain. Here are programmed the basic instincts of survival - sexual desire, the search for food and the "fight-or-flight" response. The prime directive of the Reptile Brain is "survival through competition".

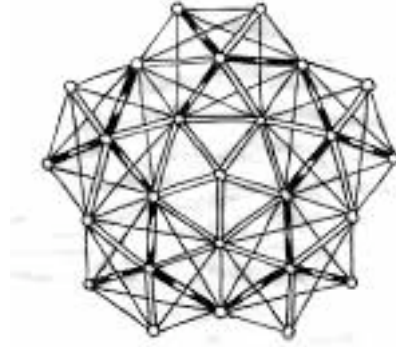
(There are those who romanticize the Reptile Brain as something lofty and "natural", but the "nature" expressed there is the law of the jungle. It lacks both humor and lofty ideals.)

Many of its "solutions" are apropos of our distant ancestors and may not work so well in the Information Age. This primitive software can be activated by stressful or dangerous situations and may do more harm than good (e.g.. shoulder and neck tension while driving, excessive adrenal reaction creating hypertension, hypervigilance leading to insomnia, etc.). Until experience and reflection show more effective, dependable behavioral options, our body/mind response is to go with what is familiar.

The Power of Tensegrity.

In taiji we are looking for a way to transcend and access the lizard brain and still be effective. That comes from years of practice aided by an understanding of what

principles are at work. Tensegrity is a term coined by the inventor/ architect/ philosopher, R. Buckminster Fuller. It means a continuous tensional network supported by discontinuous compressive elements (see sketch).



A tent is an example of a tensegrity network. Ropes or cables pull in different directions, creating the form of the tent. Cut one of the ropes and the whole tent loses some of its form. Overtighten, and the shape is distorted, weakening the structure.

The tent pegs and poles are the “discontinuous compressive elements”. They act as “spacers” to help direct the lines of force of the tensional elements. Force is not taken directly into them.

The bones/muscles/connective tissue act as a tensegrity network in the body. Juhan says, “There is not a single horizontal surface anywhere in the skeleton for anything to be stacked upon it. Our design was not conceived by a stone mason. Weight applied to any bone would cause it to slide right off its joints if it were not for the tensional balances that hold it in place and control its pivoting.” (JOB’S BODY p.82)

Tensegrity accounts for the body’s ability to absorb impact without damage. The more relaxed and flexible the body, the more likely that energy will be taken in as information rather than injury. Muscular tension interferes with this network and diminishes the ability to disperse energy without damage.

Structurally, we are creating shapes with our bodies that allow the energy to move where we want it to go by relaxing into the natural support of this tensegrity network. This is what is called “sung” in taiji. Extensive experimentation is required to have a personal sense of which shapes support this process and which shapes oppose it.

It is along this tensegrity network that energy and information flow, which is vital to the survival of the organism. In the Yang Family Forty Chapters (see LOST T’AI CHI CLASSICS FROM THE LATE CH’ING DYNASTY by Douglas Wile), it is said “Ch’i

travels in the membranes, bones, sinews, and blood vessels; strength issues from the blood, flesh, skin, and bones. Therefore, those with great brute force will have external strength in their skin and bones, or physical form. Those with great ch'i have internal strength in their sinews and blood vessels, or physical image...Circulating the ch'i in the sinews and blood vessels and using strength in the skin and bones are very different." (page 79)

When we respond to stress by focusing on our muscles, it is like shortening one or more of the supporting wires of the tent, it interrupts the balance and integrity of the structure. When we focus on the tensegrity network (sinews) we utilize the power and intelligence of the whole body.

Taijiquan is the most effective practice I have seen for implementing these ideas into the way we move and act in the world. We first find out how to relax into the tensegrity of the connective tissue, then gradually increase the resistance while maintaining the relaxation. Over time, we learn how to handle enormous forces calmly and gracefully.

These principles can be applied to any form, any move. The only way to convince the "old guard" of the body/mind, the "reptile brain", is through practice and testing. Testing what we learn is the only way to develop confidence in the incredible potential in this magnificent art form.

Summary.

To summarize the points here:

1. Joints are designed to move a certain way and function optimally within a certain range. To reduce possibility of injury and greatly increase the power of a particular motion, it is important to test this idea against gradually increasing resistance.
2. The body has self-protecting mechanisms which alert us to potentially dangerous situations. That we can override these signals, doesn't mean we should. Understanding the language of our bodies is a lifelong undertaking, constantly refined.
3. The tensegrity system of connective tissue and bone in the body is an effective system of transmitting energy and information. Relaxing into this underlying tensegrity permits optimal functioning. Training by gradually increasing resistance on the system while relaxing muscular tension greatly increases the ability of the body to issue and receive energy.
4. Relaxation into the intrinsic structure of the body permits functioning to be directed by the higher centers of the brain while maintaining access to the valuable functions of the lower centers.

References:

JOB'S BODY, Juhan, Deane. Station Hill Press

LOST T'AI CH'I CLASSICS OF THE LATE CH'ING DYNASTY, Douglas Wile, State University of New York Press

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