# Scientific Explanation of Kinesio® Tex Tape

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**Principle:** The Kinesio® Taping Method is based on a simple principle that the body has built-in healing mechanisms healthcare practitioners can help to positively influence their efficiency by removing barriers that impede them. Kinesio® Tex Tape provides extended soft tissue manipulation to prolong the benefits of manual therapy administered in the athletic training room or physical therapy clinic. The results are increased fluid flow through an injured area, better control over muscle contractions, reduced pain, and ultimately faster healing. This effect is modulated and coordinated by the nervous system by specifically stimulating the sensory motor system.

**Product:** The unique design of Kinesio® Tex Tape allows for unidirectional elasticity up to 60% beyond its resting length. Its thickness and weight are approximate to the human dermis layer which allows for comfortable prolonged wear times. The adhesive backing is a heat activated acrylic and does not contain latex. The tape is also water resistant and withstands high moisture environments in addition to sweating.

**Philosophy:** Based upon years of clinical use, Kinesio® Tex Tape is specifically applied to the athlete or patient based upon their needs after evaluation. The findings of the clinical evaluation or assessment dictate the direction in which the tape is applied, the cut of the tape as well as how much stretch will be utilized. These parameters are vitally important to successful clinical management of musculoskeletal complaints with the Kinesio® Taping Method. When Dr. Kase first began using his method and experimenting with taping Kinesio® Tex Tape had yet to be developed. He used the traditional white athletic tape and observed adverse results on the skin, but achieved his objectives in treating the clinical condition. It was then he decided to begin development of a tape that would mimic the qualities of human skin in order to achieve the results we see today.

**Program:** The direction in which the tape is applied can be used to either influence muscle facilitation or inhibition. This construct, while presently theoretical, has been used to explain many various muscle energy techniques such as post-isometric relaxation, reciprocal inhibition and proprioceptive neuromuscular facilitation. Dr. Leon Chaitow's work has demonstrated that pressure directed away from the belly of a muscle, towards the Golgi tendon organs produces relaxation of the muscle, while pressure toward the belly of the muscle, from the region of the Golgi tendon organs, tones and or strengthens it. Pressure directed near the belly of the muscle, towards the muscle spindle, weakens it, while pressure away from the spindle near the belly, tones and or strengthens it.

**Physiologic:** There are five major physiologic effects of the Kinesio® Taping Method and its applications.

1. Skin Function: The expanding and contracting properties of the Kinesio® Tex Tape provides gentle sensory stimulation to various types of sensory receptors in the skin during movement (Ruffini, Meissner, Pacinian, Krause's bulb, Merkel's disk, free nerve

endings, hair follicles etc.). This activates the spinal inhibitory system through stimulation of touch receptors and activates the descending inhibitory system to decrease pain via the Gate Control Theory, proposed by Melzack and Wall. This theory states that touch and proprioceptive peripheral nerve fibers (a beta) are rapidly conducting and they transmit information to the substantia gelatinosa (SG) and other spinal cord neurons. The SG neurons inhibit both pain transmission nerve fiber input and proprioception to the transmission neurons of the spinothalamic and spinoreticulothalamic tracts. Therefore, pain control can be modulated by other sensory input. A newer pain theory, the Neuromatrix theory, also states that pain is result of the wider neural network than just the small afferents. Because of this wider network there are many pathways that contribute to the "pain response". It is likely there are two modes of pain perception: a more acute sensory experience (small afferents modulated by the larger afferents) and a prolonged sense of pain produced through the neural matrix (from many centers). Kinesio tape may affect both types of sensory input, and potentiate a global physiologic influence.

2. Circulatory and/or lymph: The lymphatic drainage system contains both superficial and deep lymphatic vessels which can become filled in response to localized inflammation. Kinesio® Tex Taping takes advantage of the mechanical connection of the anchoring filaments to the endothelial cells. By way of connection to the dermal layer the lymphatic channels can be "opened up" by the elastic qualities of the tape, creating the characteristic convolutions on the tape. This allows for the lymph obligatory load to fill the lymphatic capillaries toward areas of decrease pressure under the Kinesio® Tex Tape, which allows fluid to move more freely. The elastic property of Kinesio® Tex Tape also creates a gentle massage with movement. Pressure changes and movement of the skin open and close the initial lymphatic vessels via filament attachments as well. The effect of taping muscles enhances the deeper lymphatic mechanisms. Kinesio® Tex Taping on the superficial lymphatics encourages edema movement. The edema reduction removes heat and chemical substances in tissue, improving circulation and reducing trigger points. Decreasing pressure and chemical receptors reduces pain and improves the return of normal sensation. The lymphatic system is generally a low-pressure operating system. Inappropriate external pressure or partial gradients, scar tissue, or a range of chronic superficial tissue changes can easily close it down. This ultimately may result in an inflammatory outcome.

3. Fascia: An uninterrupted, three-dimensional web of tissue that extends from head to toe, front to back, from interior to exterior. Fascia is responsible for maintaining structural integrity; for providing support protection; acting as a force dampener. Fascia has an essential role in hemodynamic and biochemical processes, and provides a major matrix for intracellular communication. Fascia also functions as the body's first line of defense against pathogenic agents and infection. After injury, it is the fascia that creates an environment for tissue repair. Fascia extends to all fibers connected tissues, including apponeuroses, ligaments, tendons, retinacula, joint capsules, organ and vessel tunics, epineurium, meninges, periosteum and all the endomysial and intramuscular fibers of the myofascia.. This interconnected nature of fascia means that everything in the body is structurally connected. When fascia is too tight, your muscles ability to perform optimally and repair is restricted. This tightness can also alter biomechanics and cause

mechanical compensation in other areas. If this fascial contraction persists, fibroblasts will secrete collagen and other proteins into the extracellular matrix where they bind to existing proteins, making the composition thicker and less extensible. While this increases the tensile strength of the fascia, it can unfortunately restrict the very structure it aims to protect. This may result in a mild decrease in joint range of motion to fascial binding of muscles, nerves and blood vessels (e.g. Compartment syndromes). If this fascial contraction can be interrupted, then a reorganization of the fascia can occur. The fascia then will normalize its composition and tone and the extra material that was generated by prolonged contraction will be ingested by macro phages within the extracellular matrix. Considering the two previous physiologic effects, Kinesio® Tex Taping, when applied correctly, can help minimize this fascial contraction during soft tissue injury or help reorganize the fascia during chronic injury.

4. Muscle: The elastic properties of Kinesio® Tex Tape replicates and enhances the function of muscle fibers and tendons. Golgi tendon organs (GTO) are specialized mechanical receptors that are found at muscle tendon junctions. A single 1B caliber nerve fiber forms elaborate sprays that intertwine with tendon fiber bundles enclosed with the connective tissue capsule. A dozen or more muscle fibers insert into these intracapsular tendon fibers, which are in series with the muscle fibers. The bulbous nerve endings are activated by the attenuation that develops during muscle contraction. Because the rate of impulse discharged on the parent fiber is related to the applied tension. Tendon endings signal the force of muscle contraction. Stimulation of the GTO by direct pressure has been well documented by Rood and others to inhibit muscle over activation. Research has also revealed that the GTO is responsible for controlling the muscle spindle throughout movement. It modulates and modifies tension of the muscle spindle directly in response from feedback from the antagonist muscle to create controlled coordinated motion.

Muscle spindles are up to 1 cm in length and vary in number from a dozen to several hundred in different muscles. They are abundant in the antigravity muscles along the vertebral column, femur, and tibia; in the muscles of the neck; and in the intrinsic muscles of the hand. All these muscles are rich in slow, oxidative muscle fibers. Spindles are scarce where FG or FOG fibers predominate. Muscle spindles contain up to a dozen intrafusal muscle fibers (ordinary muscle fibers are extrafusal in this context). The larger intrafusal fibers emerge from the poles (ends) of the spindles and are anchored to connective tissue (perimysium). Smaller ones are anchored to the collagenous spindle capsule. At the spindle equator (middle), sarcomeres are replaced almost entirely by nuclei, in the form of "bags" (in wide fibers) or "chains" (in slender fibers). Muscle spindles have both a motor and sensory nerve supply. The motor fibers, called fusimotor, are in the A□ size range, in contrast to the A□ fibers supplying extrafusal muscle. The fusimotor axons divide to supply the striated segments at both ends of the intrafusal muscles. A single primary sensory fiber of type Ia caliber applies annualospiral wrappings around the bag or chain segments of the intrafusal muscle fibers. Secondary "flower spray" sensory endings on one or both sides of the primary are supplied by type II fibers.

During muscle tension the strands of collagen are stretched as long as 3 inches. The muscle length changes (concentric or eccentric contractions). The stretching deforms at terminals of the Ib afferent axon, opening stretch-sensitive cat ion channels. As a result,

the axon is depolarized and fires nerve impulses up to the central nervous system via the spinal cord. The action potential frequency signals the force being developed within the muscle. The sensory feedback plays important role in spinal reflexes in the central control of muscle contraction. Specifically, it is postulated that because the GTO exists in serial connection with muscle fibers, it can measure the tension that each muscle contraction builds up. The Ib afferent axon synapses with interneurons within the spinal cord and also relays information to the brain. One of the main spinal reflexes receiving an input from the Ib afferent is the autogenic inhibition reflex, which is involved with the regulation of the force profile of ongoing muscle contractions. In other words the GTO will cause "contraction failure" to protect the muscle and tendons from excessive force. It is by these mechanisms that Kinesio® Tex Taping, when applied correctly, can take advantage of the neural control of human movement.

5. Joint: Joint function can also be improved by stimulating the proprioceptors in the joints passive restraint system by application of Kinesio® Tex Tape over the ligaments. The proprioceptors in the ligaments and joints capsules provide information to the nervous system which allows the musculoskeletal system to provide appropriate movement to the injured joint. Free-ending unmyelinated nerve fibers are abundant and joint ligaments and capsules, and in the outer parts of the intraarticular menisci. They mediate pain when a joint is strained, and they operate in excitatory reflex to protect the capsule. For example, the anterior wrist capsule is supplied by the median and ulnar nerve; if it is suddenly stretched by forced extension, motor fibers in these nerves are reflexively activated and cause wrist flexion. Experiments have shown that, when a joint is inflamed, more free-ending nerve fibers are excited than when a healthy joint capsule is stretched. It seems that some nerve endings are only stimulated by inflammation. Encapsulating nerve endings in and around joint capsules include Ruffini endings that signal tension, lamallated endings responsive to pressure, and the simian corpuscles responsive to vibration.

**Practical:** Kinesio® Tex Tape can be worn 24 hours a day for 3 to 5 continuous days due to its unique physical properties. It can be applied during any phase of injury as it can be clinically utilized to initially reduce inflammation and progress through all phases of rehabilitation. Due to its versatility, it can be used in conjunction with many different modalities as well. During the Summer Olympics in Beijing China 50,000 roles of Kinesio® Tex Tape were utilized and it was seen on over 200 athletes during its three weeks. Over one third of Major League Soccer clubs utilize Kinesio® Tex Tape in addition to international teams. Major League Baseball and the NFL utilize Kinesio® Tex Tape. Most recently it was seen being utilized in the Super Bowl. It is utilized by every professional sport in Japan and is being utilized in over 73 countries around the world.