*Research review of the **ArmLock brace**: A Therapeutic Stretching Tool for the Treatment of Chronic Tennis Elbow.*

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Introduction:

Tens of thousands of Canadians (1-3%) suffer from tennis elbow, a painful condition that interferes with work, recreation and daily life. Clinical reasoning about musculoskeletal pain is dominated by attention to physiological structure. However, no reliable correlation has been found between either the onset or resolution of tennis elbow symptoms and the physical condition of associated tissues. Tendon degeneration can be asymptomatic up to (and even after) rupture. However, most cases of tennis elbow exhibit the opposite disjuncture: structurally adequate tendons sidelined by debilitating pain. This disconnect should be deeply disconcerting, since practically all mainstream interventions assume a relatively straightforward link between tissue and pain. Tennis elbow, like most tendinopathies, very frequently transitions from being an acute injury with peripheral sensory drivers to a chronic pain condition wherein symptoms are the consequence not of injured tissue, but neural sensitization. The intent of this article is to review the research on a novel product, the ArmLock brace, as well to elucidate the possible rationales for how a sustained stretch, as provided by the ArmLock brace, may help treat this challenging condition.

Theoretical Framework:

<u>How trigger points might form:</u>

Trigger points within the muscles on the back of the forearm refer pain to the outside of the elbow. (1) Reduced oxygenation to the muscles may be a contributing factor to their creation. Isometric muscle contractions induce higher levels of muscle hypoxia, in comparison to isotonic muscle contractions. (2) In a study of rock climbers, near-Infrared spectroscopy revealed a clear, progressive decline in forearm muscle oxygenation over a 60-second static isometric gripping contraction. (3) In a study on quadriceps isometric contractions, the major arteries would not occlude, irrespective of the contraction intensity. (4) However, despite this continued flow through the major artery, local muscle oxygenation levels declined rapidly and considerably with the isometric contraction. In accordance with Laplace's law, increasing intramuscular pressures disproportionately compress arterioles and the capillary network, thereby promoting tissue hypoxia during these sustained static contractions.

Many occupations require these static muscle contractions which increase in intramuscular pressure, temporarily affecting the micro-circulation. Often, these static muscular contractions occur when the muscles are contracting at or near the inner range of the muscle. Statically holding fingers over a keyboard or a mouse, holding tools with the fingertips, grabbing and holding onto larger items with the fingers extended; all activities that involve a static contraction with the dorsal forearm musculature at inner range. At this inner range, there is maximum overlap actin and myosin molecules and maximum energy requirements.

When calcium binds to troponin on the muscle fibers, the muscle fibers contract. For the release of this contraction, ATP is needed to actively pump calcium back into the sarcoplasmic reticulum. The increased demand for and reduced supply of ATP forms an 'energy crisis' within the muscle tissues, contributing to the creation of myofascial trigger points (MTrPs). As well, this hypoxic environment may evoke the release of neuro-reactive substances and metabolic byproducts which could sensitize peripheral nociceptors (5,6)

Repetitive work involving isometric contractions, over the years, may contribute to more than just myofascial trigger points. Mechanical properties of the muscle containing MTrPs were quantitatively assessed by tracking the speed of an externally induced vibration as it propagates through tissue. This method is known as shear wave elastography. Using shear wave elastography, affected muscle in subjects with active MTrPs has been shown to be stiffer compared to palpably normal muscle (21). This lends further evidence towards an understanding that the source of pain may not just be from the trigger point. Pain may also stem from a more pervasive process that impacts the neighboring muscle and fascia.

In the treatment of trigger points, Simons and Travell hypothesized the method of "spray and stretch" was effective because it targeted an "energy crisis" in the region of the MTrP. Stretching the muscles would lengthen the sarcomere and reduce overlap between actin and myosin molecules, decreasing the need for ATP and breaking the vicious cycle of the "energy crisis" (1). Simons and Travell were enthusiastic about this technique, calling it the "workhorse" of myofascial therapy. As the spray was found to be harmful for the ozone layer, this approach was abandoned. The current research on the ArmLock supports that a low load, prolonged stretch, may be an effective method of releasing these affected tissues associated with tennis elbow.

<u>Why a low-load prolonged stretch?</u>

Individuals with tennis elbow often exhibit reduced extensibility in their wrist extensor musculature. (7) Comparative research offers valuable insight into optimal stretching strategies for this muscle–tendon complex. One study demonstrated that a low-load, prolonged stretch applied for 50 minutes effectively promoted tissue elongation. (8)

However, caution is warranted: excessive or rapid stretching can lead to adverse effects. For example, in limb lengthening procedures, if bone is elongated too quickly, the surrounding fascial and collagenous tissues may fail to regenerate at a matching rate. This mismatch can result in micro-tearing and fibrosis, ultimately compromising limb mobility and function. (10) To mitigate such risks, stretching within the toe region of the stress strain curve (ie. gentle stretch) for less than an hour per day should prevent any fibrosis from occurring. Incorporating heat into these protocols has been found to significantly enhance tissue extensibility. (8,9)

<u>Neuro-Modulatory perspective</u>:

Stretching exercises are widely recognized for their therapeutic effects on chronic musculoskeletal, nociplastic, and neuropathic pain. Stove et al. (10) demonstrated that regular stretching significantly reduced both regional and widespread pain sensitivity. A systematic review by Konrad et al., which screened 797 studies and included six eligible trials, examined the long-term effects of stretching on musculoskeletal pain. (11) Intervention durations ranged from four weeks to six months. Five of the six studies reported meaningful reductions in pain scores or decreases in pain prevalence and severity. These findings suggest that stretching may alleviate pain by improving range of motion and reducing muscle stiffness—mechanisms that may reduce nerve compression and modulate muscle spindle activity.

Prolonged passive stretching, particularly when held for several minutes, has been shown to reduce the sensitivity of type Ia afferent fibers—key components in detecting dynamic changes in muscle length. These effects are time-dependent: longer stretch durations produce greater reductions in Ia-mediated reflex activity, leading to decreased stretch reflex excitability and lower force output. Importantly, these changes reflect spinal and supraspinal adaptations, supporting a model of central nervous system modulation rather than purely mechanical tissue elongation (12).

Muscle spindles respond robustly to rapid stretch but far less to slow, sustained tension. Holding a muscle under low-load stretch for several minutes diminishes Ia afferent output, thereby reducing stretch reflex activity and involuntary muscle contraction. This results in decreased muscle guarding and tone, reduced perceived threat, and lower pain sensitivity. Sustained stretching also promotes viscoelastic lengthening (stress relaxation) without inducing micro-tears, shifting the muscle–tendon unit to a new resting tension baseline and further suppressing spindle firing. Collectively, these effects reduce nociceptive input to the spinal cord. When performed daily, such stretching may contribute to central downregulation of pain sensitivity, allowing the nervous system to “relearn” that tension is not inherently threatening.

Animal studies further support this model. Corey et al. investigated the effects of stretching in rats injected with a tissue irritant. Rats subjected to 10 minutes of stretch twice daily for 12 days showed significant reductions in skin sensitivity and improvements in gait and stride length compared to non-stretched controls (11). While it remains unclear whether these changes reflect peripheral tissue adaptation or central desensitization, the findings suggest that repeated exposure to end-range motion may reduce movement-related fear and hypersensitivity.

From a sensory modulation standpoint, chronic stretching appears to alter the perception of discomfort rather than induce substantial morphological changes in muscle tissue. As observed with the ArmLock brace, improvements in pain did not correlate with measurable gains in muscle extensibility. This implies that the clinical benefit may be primarily neuro modulatory. One plausible mechanism is the “pain reduces pain” model, also known as the Counter-irritant Theory—a modern interpretation of the Gate Control Theory. Thirty minutes of gentle, sustained stretch provides a robust sensory stimulus to the forearm’s mechanoreceptors. Because tennis elbow pain is often triggered by sudden increases in tension, as occurs during active contraction of the dorsal forearm muscles, the treatment of providing a gentle, sustained tensile load—delivered for 30 minutes daily through a passive stretching device—can gradually desensitize the tissues to both passive stretch and active contraction.

Tension as the stimulus to heal:

Tissue tension can serve as a therapeutic stimulus to promote healing. In chronic lateral epicondylitis, the common extensor tendon typically exhibits a pathological composition: densely packed fibroblasts, disorganized immature collagen, and a notable absence of inflammatory cells. (12) Fibroblasts comprise approximately 20% of tendon tissue volume, (13) and mechanical stress applied to these cells has been shown to enhance connective tissue synthesis while downregulating inflammatory mediators. (14) In vitro studies using cultured skin fibroblasts demonstrate that mechanical stimulation aligns both extracellular matrix and cytoskeletal components along the axis of tension, thereby increasing tensile strength. (15,16)

Gentle, sustained stretching may therefore be an effective physiotherapeutic strategy to activate tenocytes (tendon fibroblasts), encouraging the synthesis of collagen fibers oriented in the direction of mechanical stress. This process can accelerate tissue repair and improve extensibility, potentially facilitating a faster return to occupational or athletic function. In contrast, patients who rely solely on rest or protective splinting may fail to provide the necessary mechanical stimulus required for tendon remodeling and recovery.

Anatomical considerations:

The ArmLock manual stretch or the ArmLock brace applies tension to all the tissues on the dorsal forearm. Prior teachings suggested overuse of the wrist extensor, specifically Extensor Carpi Radialis Brevis (ECRB), as the primary culprit of tennis elbow.(17) The finger extensors, however, constitute up to 45% of the wrist extension moment potential.(18) Anatomical dissection has found that both the wrist extensor, specifically ECRB, and the finger extensors (EDC) converge to form a common tendon. It could be inferred therefore that any pathology associated with the wrist extensor origin would therefore have to be treated as common to both the EDC and ECRB.(17) A more recent anatomical analysis analyzed thirty-nine cadaver arms and found that the index and middle finger extensor tendons converged with the wrist extensor (ECRB) at the lateral epicondyle, whereas the ring and little finger did not.(19) Therefore, a contraction of either muscle group, wrist extensor or finger extensor, independent of the other, or pathological shortening in response to repeated trauma, would increase tension on the common extensor tendon, and in the case of tennis elbow, elicit pain. A study of tennis elbow patients looked at pain on resisted extension of the middle finger (Maudsley's test) which was found to be positive in a significant portion of the subjects with tennis elbow. (20) Their conclusion was that the finger extensors may play a greater role in tennis elbow than previously appreciated. In managing tennis elbow, the importance of targeting the finger extensors becomes unmistakable.

To stretch the finger extensors, all the joints of the hand must be positioned into flexion. As the common extensor tendon originates proximal to the radial humeral joint, the elbow must also be held in extension with the forearm fully pronated. Now, with the elbow and finger joints locked into their respective end ranges of motion, the therapist (or the ArmLock Brace) controls the amount of tension applied to the tissues with varying degrees of flexion at the wrist. Basically, lock everything in the arm, then slowly flex the wrist.

Rationale for the creation of the ArmLock Brace: as written by the creator, Mark Laurensse, physiotherapist from Edmonton, Alberta

While treating patients with chronic tennis elbow, I was struck by how markedly restricted the dorsal forearm muscles had become. When I began experimenting with a low-load, prolonged stretch, (image 1) I found that there was no immediate change in symptoms. However, after applying this approach consistently over several sessions, patients began progressing noticeably faster than they ever had with traditional therapy alone.

Image 1

This is a very difficult manual stretch to perform, and with a larger patient, and a smaller therapist, it would be impossible. It is also not possible for the patient to actively hold this stretch independently for more than a minute or two.

I came up with the concept for the ArmLock brace purely by accident. My wife had plantar fasciitis, and I bought her a Strassburg Sock to help her treat it. Goofing around, I put the sock on my arm and had my eureka moment. “This is how I stretch my patients!” I converted the end of the sock to a glove and added a stabilizing bar, and voila! The ArmLock was invented! (Image 2). Confident in how effective this treatment was in treating chronic tennis elbow, I approached the University of Alberta to engage in a study.

Image 2

The following link directly connects you with the published study.

https://rehab.jmir.org/2026/1/e80400

Below is a summary of the research which aims to support the treatment of chronic tennis elbow through a method of a low load prolonged stretch through either a manual stretching technique or an applied brace, the ArmLock. The research was conducted out of the University of Alberta, Department of Rehabilitative Medicine from March, 2020 to April, 2023, by Antonio Miguel Cruz PhD, Assistant teaching Professor, Dept. of OT, and Adriana Rios Rincon, PhD, Assistant Professor, Dept. OT.

Method and Results:

The objective of this study was to investigate the effects of sustained tension over the three muscles that attach to the outside of the elbow, as provided by the ArmLock brace. 19 patients with chronic tennis elbow were enrolled in this pilot study. They were to wear the ArmLock brace for 30 minutes per day. The patients were assessed on initial intake, at 6 weeks and again at 12 weeks.

Measured Variables:

1.) **Pain intensity** and **functional disability** as measured through the 'Patient Rated Tennis Elbow Evaluation (**PRTEE**).

2.) **Composite extensibility** of the dorsal forearm muscles.

3.) **Pain free grip strength**, which is the maximal grip strength at which pain appears.

Contraindications:

1.) Steroid injection within the last three months.

2.) Arthritis of the fingers, wrist or elbow.

3.) Wounds where the brace will be applied.

4.) Prior lateral epicondyle surgery.

5.) Prior elbow dislocation.

6.) Any neurological changes of the affected upper extremity.

7.) Reproduction of pain on cervical or thoracic nerve compression.

8.) Pain on ligament stress testing of the elbow.

9.) Racket sports. The inventor found that the ArmLock worked much better for repetitive strain type tennis elbow than tennis elbow elicited from racket sports.

Indications:

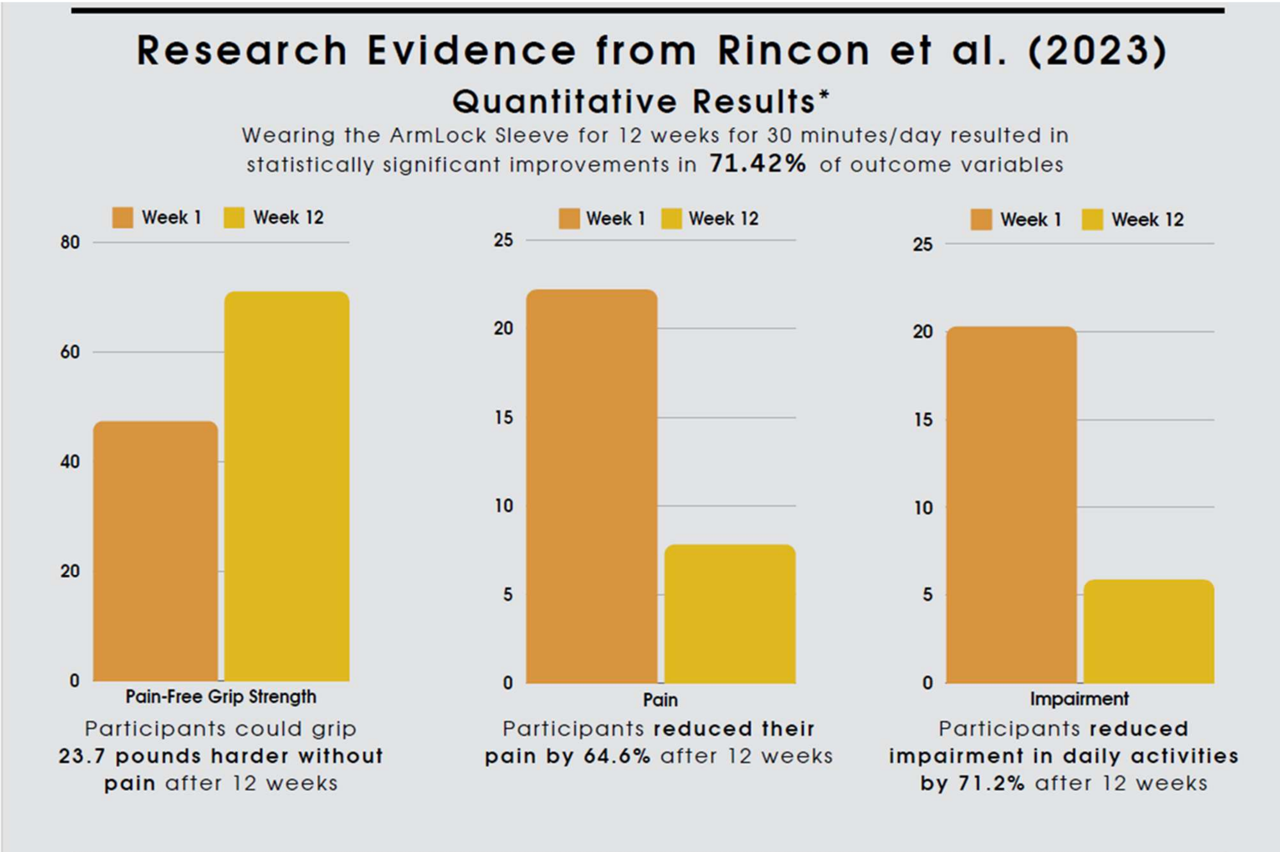
1) Individuals with chronic lateral epicondylitis who experience the following symptoms: (1). Typical pain on the lateral side of the elbow elicited by resisted wrist extension; (2) tenderness at the lateral epicondyle; (3) measurable loss in composite muscle flexibility (extensibility); and (4) symptoms lasting for at least 12 weeks.

2) Age greater or equal to 18 years.

Results:

5 variables were assessed on intake, at 6 weeks and again at 12 weeks. Image 3 highlights three key variables

Image 3.



Analysis of the data: Very significant improvements were attained in the reduction in pain, the improvement in impairment and the increase in Pain-Free Grip Strength. Improvements in Flexibility (extensibility) of the dorsal forearm muscles was surprisingly marginal. Point tenderness at the elbow also did not change significantly.

User Experience:

1.) Analysis of the Interviews indicates that participants had overall positive experiences with the ArmLock Brace, noting its effectiveness in reducing their tennis elbow symptoms. They consistently expressed satisfaction, highlighting significant improvements such as reduced pain, decreased discomfort, and improved arm functionality, enabling them to engage in their desired activities. There were a few patients that stated they found no improvement with the use of the ArmLock brace.

2.) Reinforcing of the stitching emerged as a key recommendation to enhance the durability of the device.

3.) In terms of usability, most participants found it easy to learn how to put on and remove the ArmLock Brace. However, some participants faced challenges in achieving optimal tightness and correctly using the straps. Uncertainties about proper wear, as well as occasional experiences of numbness, tingling, or soreness while wearing the device were also reported. Moreover, adhering to the recommended 30-minute daily usage posed some challenges for certain participants.

Discussion:

Tennis elbow is often found to occur in occupations that involve static gripping or pinching activities, especially with the muscles contracting at inner range. Tissue ischemia that occurs from an increase in intramuscular pressure may play a role in the development of trigger points within the forearm. Traditional methods of stretching for one minute may not be long enough to adequately stimulate the tendon cells to promote healing or long enough to desensitize these tissues. As the finger extensors blend to form part of the common extensor tendon, it is essential to incorporate this muscle group into the treatment of tennis elbow.

Conclusion:

The rationale behind the ArmLock technique and brace is grounded in well-established anatomical, neurological, and biomechanical principles. This method systematically targets the dorsal forearm musculature implicated in lateral epicondylalgia, delivering sustained, low-load tension across the affected region. By applying stretch to the musculotendinous unit, the ArmLock directs mechanical input to myofascial trigger points known to refer pain to the lateral elbow, potentially "pulling them out" and reducing their irritability.

Prolonged passive stretching also attenuates the sensitivity of muscle spindle Ia afferents, contributing to central downregulation of pain processing and a reduction in protective muscle guarding. In parallel, sustained mechanical tension serves as a potent stimulus for tenocytes, promoting the synthesis and alignment of collagen fibers along the direction of applied stress. Together, these mechanisms support both neuro-modulatory and tissue-reparative pathways, offering a comprehensive, non-invasive approach to managing chronic lateral elbow pain.

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