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Myofascial trigger points and whiplash-associated disorder: The role of trigger point injections

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Purpose Statement

This white paper reviews myofascial trigger points (TrPs) as pain generators in whiplash-associated disorder (WAD), outlines relevant pathophysiology, and summarizes management with ultrasound-guided trigger point injections (TPIs). Emphasis is placed on early identification and treatment to reduce the risk of chronic myofascial pain in WAD.

Executive Summary

Myofascial trigger points (TrPs) are major drivers of pain and functional loss in whiplash-associated disorder (WAD). When accurately identified and treated with ultrasound-guided trigger point injections (TPIs), patients experience reliable symptom relief. Early TrP diagnosis and management may also reduce central sensitization and the transition to chronic pain. Outcomes reported in the literature align with results observed in our facility.

Key Findings

- Definition: A myofascial trigger point (TrP) is a painful, taut band within muscle that produces local tenderness and/or referred pain.
- Prevalence in WAD: Studies show a high prevalence of TrPs among WAD patients, including years after a motor vehicle accident (MVA).
- Pathophysiology: TrPs exhibit distinct intramuscular physiology compared with unaffected muscle, likely contributing to regional hypersensitivity.
- Diagnostic nuance: TrP pain often mimics other WAD-related injuries due to characteristic referral patterns, complicating localization without skilled examination.
- Therapeutic efficacy: Trigger point injections (TPIs) have demonstrated meaningful symptom reduction across multiple trials.
- Role of ultrasound: Ultrasound improves diagnostic accuracy, guides precise needle placement, and enhances safety near structures such as the pleura and neural tissue.
- Prevention of chronification: Timely identification and treatment of TrPs may limit central sensitization, lowering the risk of chronic pain and long-term disability.

Implications

Trigger point injections (TPIs) have demonstrated effectiveness for reducing pain and improving function in whiplash-associated disorder (WAD). Early recognition and management of symptoms arising from myofascial trigger points (TrPs) should be standard practice to control symptoms and accurately identify pain generators. Professionals providing medico-legal guidance are encouraged to refer to providers with demonstrated expertise in ultrasound-guided TPIs and TrP evaluation.

Introduction

Whiplash-associated disorder (WAD) commonly follows a motor vehicle accident (MVA) or other trauma and may involve multiple systems, spinal joints and discs, nerves, muscles, tendons, ligaments, and other soft tissues.[1–7] This multisystem involvement complicates treatment and can be associated with guarded prognosis depending on patient and injury factors.[8–14]

A key contributor to post-whiplash symptoms is the myofascial system, muscle, connective tissue, and fascia containing neural, vascular, and lymphatic components.[15,16] Trauma can precipitate myofascial trigger points (TrPs), which are frequently implicated as primary pain sources after whiplash.[17,18] TrPs and myofascial pain are prevalent in persistent musculoskeletal and MVA-related pain populations.[19,20] When untreated, they can worsen outcomes, increase healthcare utilization, and diminish productivity. In 2010 U.S. estimates, the annual costs of pain exceeded those of heart disease, cancer, or diabetes, and were nearly 30% higher than the combined costs of cancer and diabetes.[21]

For additional pathophysiology and biomechanics background, see our companion white paper, “Whiplash: An In-Depth Review of Pathology and the Biomechanics of Injury.”

During whiplash-associated disorder (WAD), the myofascial system undergoes eccentric loading, muscles contract while lengthening, producing strain, microtears, and pain. Because motor vehicle accidents (MVAs) impart multidirectional forces across the spine, any cervical, thoracic, or lumbosacral muscle can be affected.[22] (For detailed biomechanics, see “Whiplash: An In-Depth Review of Pathology and the Biomechanics of Injury.”)

Multiple models explain how myofascial trigger points (TrPs) form and persist. Early work (1942) proposed that metabolite accumulation sensitizes gamma motor neurons, increasing muscle-spindle reactivity and alpha motor neuron drive, culminating in hypertonic “knots.”[23] Later, Simons and colleagues characterized TrPs as hyperirritable foci within taut bands capable of nociceptive signaling.[24,25] Biochemical studies by Shah et al. demonstrated that active TrPs contain elevated bradykinin, calcitonin gene–related peptide, substance P, tumor necrosis factor-α, interleukin-1β, serotonin, and norepinephrine compared with normal muscle, confirming a distinct, pain-generating microenvironment.[26] Dommerholt and co-authors synthesized these findings, describing abnormal acetylcholine (ACh) dynamics that sustain sarcomere contraction, reduce local oxygenation, lower pH, and accumulate inflammatory mediators, conditions that maintain TrPs.[27]

Clinically, TrP regions exhibit reduced pain thresholds and altered proprioception; persistent nociceptive input from these sites promotes central sensitization, a heightened amplification of pain signals in the central nervous system.[28–30] Chronic involvement is common: in a cohort of 54 patients with chronic whiplash (~2.5 years post-MVA), clinically relevant TrPs were present in every case,[18] and large-scale data show myofascial pain in 80% of 1,096 MVA subjects.[31] Continued peripheral signaling can induce central changes that increase the intensity and durability of pain.[32–36] Collectively, these mechanisms position myofascial pain and TrPs as integral, and treatable, targets within the complex WAD pain phenotype.

Clinical Presentation and Diagnosis

In whiplash-associated disorder (WAD), myofascial trigger points (TrPs) can be difficult to recognize because global pain and overlapping injuries obscure localization. Diagnosis is primarily clinical, integrating targeted palpation, characteristic referred-pain descriptors, and exclusion of competing etiologies. Core criteria include a hypersensitive spot within a taut muscular band with reproducible referred pain; additional supportive signs may include a local twitch response, a jump sign, painful resisted contraction, and restricted range of motion.[37–39] TrPs may be active, stimulation reproduces local and referred pain or latent, producing only localized tenderness.40 In the general population, consistent TrP patterns are described in the trapezius, gluteus medius, and quadratus lumborum.[41] In WAD, clinically relevant sites frequently include the semispinalis capitis, splenius capitis, upper trapezius, rotator-cuff complex, suboccipitals, and sternocleidomastoid.[15,42,43] Because TrP referral can mimic joint or neurogenic pain, and multiple injuries often coexist after trauma, clinicians must interpret body-chart patterns cautiously and synthesize findings with a thorough musculoskeletal and neurologic examination.[24,44–46]

Diagnostic Imaging and Trigger Points

Advances in imaging have improved diagnostic confidence when differentiating TrP pain from other sources. Diagnostic ultrasound (US), which uses sound waves and their reflections, is increasingly employed in musculoskeletal practice due to its point-of-care availability, lower cost, absence of ionizing radiation, and ability to engage patients with real-time correlation of symptoms and anatomy.[47–53] In TrP assessment, US can visualize distinct features that complement physical findings and help guide interventions.[54–57] Sikdar and colleagues reported that TrPs appear as elliptic, focal hypoechoic areas corresponding to palpable nodules in all examined subjects.[54] Chen et al. found US-based TrP identification to have 100% sensitivity and ~90% accuracy and precision when confirmed with needle electromyography (EMG), concluding that US enables highly accurate and precise TrP detection.[58] Subsequent studies corroborate US as a valuable adjunct to the physical examination for accurate TrP diagnosis and targeting of treatment.[59–61]

Trigger Point Injection Therapeutics: Basic Science

Once a patient's pain is confirmed to originate from a myofascial trigger point (TrP) and validated through imaging, appropriate intervention can be initiated. One of the most widely utilized treatments is the trigger point injection (TPI).[62] This procedure involves inserting a needle under ultrasound (US) guidance into the affected muscle region and delivering an injectate, typically a local anesthetic (such as lidocaine or bupivacaine) and/or a corticosteroid (such as triamcinolone or dexamethasone).[63]

Mechanisms of Action

Local anesthetics exert their analgesic effect primarily by inhibiting voltage-gated sodium channels, which prevents neuronal depolarization and disrupts nociceptive signaling.[64,65] Additional modulation of calcium and potassium channels enhances this effect, further reducing pain transmission.[64–67] Lidocaine also promotes vasodilation via nitric oxide release in vascular tissues, improving local blood flow and reducing inflammation.[68] This dual action of neural inhibition and perfusion enhancement makes it particularly effective for managing TrP-related myofascial pain.

Corticosteroids, by contrast, act through anti-inflammatory mechanisms. They bind to intracellular glucocorticoid receptors, altering nuclear transcription to suppress cytokine production and the synthesis of pro-inflammatory mediators such as leukotrienes and prostaglandins.[69,70] The result is a reduction in both acute and chronic inflammation. (For a more detailed analysis, see "Addressing Cervical and Lumbar Facet Joint Injury in Whiplash-Associated Disorders: The Role of Steroid and Regenerative Injections.")

Mechanical Effects of Needle Insertion

In addition to pharmacologic mechanisms, mechanical needle disruption contributes significantly to therapeutic benefit.[71–77] Insertion into the taut TrP band breaks local end-plate stasis, mechanically stretching sarcomeres and releasing accumulated acetylcholine.[27,71] This often triggers the localized twitch response (LTR), a brief, involuntary contraction considered a marker of effective treatment.[78–80] The process enhances blood flow, normalizes pH, clears pain mediators, releases endogenous opioids, and reduces both active and latent TrP sensitivity, while also decreasing central hyperalgesia.[73,75,81–83]

Evidence Review: Trigger Point Injection Efficacy

Clinical research consistently supports TPI effectiveness for TrP-related pain and functional impairment. In a 2013 randomized trial, TPI significantly reduced headache frequency and intensity compared to controls.[84] Similar results were observed in geriatric patients with TrP-related headaches, where TPI outperformed dry needling.[85] A 2021 randomized controlled trial (RCT) further demonstrated that TPI markedly decreased pain and improved functional outcomes in myofascial pain syndrome.[86] Another RCT (2020) confirmed these benefits at one-month follow-up.[78]

Beyond spinal and cervical regions, TPIs have shown efficacy in masticatory muscle pain, achieving immediate symptom relief and improved headache frequency and intensity in one 2015 study[87] , and in thoracic myofascial pain syndromes as well.[88] A 2023 systematic review and meta-analysis of RCTs concluded that TPIs were superior to standard medical management for acute myofascial pain, emphasizing their "beneficial impact in reducing acute myofascial pain when compared to isolated medical management."[89] Finally, Nystrom and Freeman demonstrated that TPIs objectively modulate central sensitization in WAD-related TrP pain, confirming their dual peripheral and central therapeutic value.[90]

Optimizing Interventional Safety

Like any medical procedure, trigger point injections (TPIs) carry inherent risk, though serious complications are rare. The most significant potential adverse event is pneumothorax, or lung collapse resulting from inadvertent pleural puncture.[62,91] To reduce such risks and improve procedural accuracy, ultrasound (US) guidance has become standard practice in interventional pain management. Multiple studies have demonstrated the safety and precision advantages of US-guided TPIs.[92–94] In a systematic review, Diep et al. concluded that "all US-guided procedures resulted in zero or minimal self-limited adverse events."[95]

Beyond improved safety, US guidance enhances procedural outcomes, allowing for more accurate needle placement, reduced procedure-related pain, and higher patient satisfaction.[96–99] In a 2017 randomized controlled trial, Okmen et al. showed that deeper US-guided injections into rhomboid trigger points were significantly more effective than superficial trapezius injections for pain relief, while maintaining superior safety margins within the thoracic field.[94] Similarly, a 2015 study on myofascial pain syndrome found that US-guided injections improved outcomes and significantly decreased complications.[100] Farrow et al. (2022) echoed these findings in an emergency department setting, demonstrating that US guidance improved TrP localization and safety in patients with neck and back pain, including those with traumatic mechanisms such as whiplash-associated disorder (WAD).[101] Collectively, the evidence supports that TPIs should be performed under ultrasound guidance to optimize safety, accuracy, and therapeutic success.

Special Considerations in WAD Populations

Following a motor vehicle accident (MVA), early pain management is critical to prevent progression from acute to chronic pain. Secondary prevention, defined as early identification and treatment of acute or subacute pain to prevent chronicity, plays a pivotal role in mitigating long-term disability.[102] A central objective of early intervention is to prevent central sensitization, even when peripheral sensitization has already occurred.[102–104]

Timely and targeted intervention can normalize aberrant nociceptive signaling from peripheral pain generators such as nerves, discs, facets, or trigger points. Studies across multiple anatomical regions have shown that when these nociceptive sources are effectively treated, central sensitization can decrease or even reverse, restoring function and improving quality of life.[90,105–108] Clinical evidence also indicates that interventions delivered early in recovery yield the best outcomes, whereas delayed treatment correlates with poorer prognosis.[109,110]

Beyond biological mechanisms, the psychological component of pain significantly influences prognosis. Factors such as fear of movement (kinesiophobia), anxiety, depression, and post-traumatic stress disorder (PTSD) are well-documented predictors of chronic pain after MVA.[111–118] Notably, psychological distress identified within the first three weeks post-accident strongly predicts elevated pain levels at twelve months.119 Early control of pain symptoms can therefore positively impact both physical and psychological recovery.[120,121] Identifying patients with high-risk psychosocial or neurophysiological profiles and intervening early should be a priority in comprehensive WAD management.

Attorney Guidance and Client Welfare

For attorneys assisting clients through the medico-legal process following an MVA, understanding optimal medical management pathways is essential. Early referral to an interventional team experienced in WAD and TrP management can significantly improve patient outcomes and prevent the development of lifelong pain syndromes. A timely recommendation to the right specialist team can determine whether a patient's condition becomes chronic or resolves successfully. The evidence summarized in this white paper provides a clear, research-supported roadmap for appropriate medical decision-making in clients with WAD and TrP-related pain.

Conclusion

Patients suffering from whiplash-associated disorder commonly experience myofascial trigger point pain following an MVA. When left untreated, these localized pain generators can perpetuate central sensitization and impair quality of life. Ultrasound-guided trigger point injections represent a safe and highly effective intervention that directly addresses these pain mechanisms. Incorporating this approach early in the continuum of care enhances patient outcomes, optimizes safety, and provides clear guidance for both healthcare professionals and attorneys involved in post-accident management.

Next Steps

Attorneys seeking the best outcomes for their clients benefit from partnering with healthcare teams who understand the clinical and evidentiary principles outlined in this white paper. The practices summarized here reflect the approach used at Innovative Injury Solutions and provide a research-based framework that can support legal strategy, reduce client stress, and strengthen the burden of proof. In cases of whiplash-associated disorder (WAD), trigger point injections (TPIs) can meaningfully reduce pain and suffering. Early referral to providers experienced in ultrasound-guided TPIs and myofascial trigger point (TrP) evaluation helps prevent chronification by ensuring timely, targeted management.

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