REVIEW ARTICLE

Injection Options for the Treatment of Trigger Finger: A Review of Current Literature

Ryan Arboleda, OMS-III, MPH[1]; Matthew McDonald, OMS-III[1]; Emma Osowski, OMS-III[1]; and Kathryn Vidlock, MD[1]

[1] Rocky Vista University College of Osteopathic Medicine, Englewood, CO

KEYWORDS

Inflammation

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ABSTRACT

Introduction: Stenosing tenosynovitis of the flexor tendon, more commonly known as trigger finger (TF), is an ailment characterized by inflammation of the A1 pulley. This inflammation can eventually lead to pain and the inability to manipulate the digit. While surgical release is considered the gold standard for TF treatment, corticosteroid injection is often trialed before proceeding with surgery. It is an effective treatment for those who do not want to undergo surgery. This review aims to investigate the current literature regarding TF injection options and techniques to identify best practices and current gaps in research that warrant further investigation.

Methods: A clinical review was conducted using the keywords "trigger finger," "stenosing tenosynovitis," "injection," and "treatment." Articles discussing surgical treatment or other pathologies aside from TF were excluded. Some articles outside the search parameters were included to provide scientific and clinical context.

Discussion: There are several gaps in the current literature regarding TF treatment. Studies have shown that local anesthetic in conjunction with corticosteroid does not decrease pain associated with injection. This warrants an investigation into the continued use of local anesthetic with TF injections despite the known chondrotoxic effects. Studies have also shown mixed results regarding use of ultrasound-guided injections and long-term patient outcomes, which could benefit from repeat studies with larger sample sizes. Furthermore, the efficacy and cost-benefit of orthobioligic injectate options, such as platelet-rich plasma, require further research. Finally, further investigation of preventative treatments, such as osteopathic techniques, would benefit the field.

INTRODUCTION: ETIOLOGY, PATHOPHYSIOLOGY, AND TREATMENT PROTOCOLS

Stenosing tenosynovitis of the flexor tendon, more commonly known as trigger finger (TF), is an ailment characterized by inflammation of the A1 pulley. The cause of this inflammation is unclear, but it is hypothesized to be associated with repetitive movements, trauma, stress, and degenerative changes associated with age. This disease can affect any of the fingers, but is most common in the ring finger, followed by the thumb, long, index, and small fingers. While the progression of TF can vary between patients, inflammation of the A1 pulley leads to hypertrophy of the retinacular sheath. As the sheath continues to hypertrophy, this eventually leads to progressive restriction of the flexor tendon.[1]

TF most commonly presents in adults at or above the sixth decade of life and has a 2% to 3% lifetime risk of development. However, there is a higher incidence in diabetic patients with a lifetime risk of development of 10%.[1-3] There also seems to be a higher risk of developing TF in patients with other conditions, such as carpal tunnel, DeQuervain's tenosynovitis, thyroid diseases, rheumatoid arthritis, amyloidosis, and renal disease.[1] Clinically, initial symptoms often include catching or clicking with manipulation of the digits in flexion or extension. The catching and clicking usually starts without pain. Still, as the disease process progresses, patients will often begin complaining of pain with digital manipulation, and occasionally palpable swelling or nodules can be seen on the palmar surface of the hand just proximal to the metacarpophalangeal (MCP) joint. Pain and restricted

CORRESPONDENCE:
Ryan Arboleda, DO, MPH | ryan.arboleda@co.rvu.edu

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motion are characteristic of TF, at which point a clinical diagnosis is usually made.[2]

Conservative first-line treatment options include resting, osteopathic manipulative techniques, splinting, and nonsteroidal anti-inflammatory drugs (NSAIDs). Osteopathic techniques have been used to treat TF. Some techniques include myofascial release, muscle energy, and articulatory techniques for the carpal bones. However, only anecdotal evidence including a case report is available.[4] Oral NSAIDs are commonly recommended for pain management for TF. However, studies have yet to be conducted on the use of oral NSAIDs and their efficacy in resolving symptoms. Splinting for 6 months has been demonstrated to be roughly 50% effective in resolving symptoms of TF. If these treatment options do not relieve the patient's symptoms, corticosteroid injections or surgical release can also be an option. Corticosteroid injection of the flexor tendon sheath is an effective treatment method for managing TF, with 88% of patients perceiving improvement in symptoms and quality of life after receiving an injection in some studies.[5,6] Often, lidocaine is injected simultaneously as an anesthetic. It has been shown that single injections can provide several months of symptomatic relief, while those who receive repeat injections can have symptomatic relief for up to a year or more. With that said, many patients still opt for surgical release after several injections for more permanent relief.[7] Studies have shown that over 90% of patients who undergo percutaneous or open TF release experience complete resolution of TF symptoms.[8] While surgical release is considered the gold standard for TF treatment, corticosteroid injection is sometimes more cost-effective and is a viable treatment option for patients who do not want surgery.[9] This review aims to investigate the current literature regarding TF injection options and techniques to identify best practices and current gaps in research that warrant further investigation.

METHODS

For this narrative-style review, a search was conducted using the keywords "trigger finger," "stenosing tenosynovitis," "injection," and "treatment." The databases searched include PubMed, Scopus, and Google Scholar. Inclusion criteria included articles discussing injectate options, injection techniques, or other therapies related to TF injection. Some articles discussing other first-line treatment modalities aside from injection, such as osteopathic manipulative therapies, NSAIDs, and splinting, were also included. Articles discussing surgical treatment or other pathologies aside from TF were excluded. Some articles outside the search parameters were included to provide context. This includes articles that discuss the etiology and epidemiology of TF and other articles that discuss the mechanism of action of various injectate options.

COMPOSITION: COMPARING VARIOUS CORTICOSTEROIDS AND THE USE OF LOCAL ANESTHETIC

Traditionally, TF injections consist of a corticosteroid in addition to lidocaine, with the steroid acting as the primary therapeutic agent while the lidocaine provides an anesthetic effect. However, not all corticosteroids are equally efficacious in the treatment of TF. The choice of corticosteroids can vary from provider to provider. Still, nonsoluble corticosteroids are typically used for intra-articular injections, while soluble corticosteroids, like methylprednisolone, are more frequently used for soft-tissue injections.[10] Several studies have shown that treatment of TF using a nonsoluble corticosteroid, triamcinolone, results in higher rates of symptomatic recurrence, and patients are more likely to undergo repeat injections when compared to soluble corticosteroids like methylprednisolone and dexamethasone.[11,12] While triamcinolone has been shown to provide more rapid relief in the first few weeks of treatment,[12] soluble corticosteroid options, such as dexamethasone and methylprednisolone, have been shown to provide longer-lasting relief and are less likely to result in the recurrence of symptoms.[11]

Studies have also investigated the inclusion of local anesthetics like lidocaine and bupivacaine and their efficacy in the treatment of TF and other tendinopathies. Currently, standard practice for TF injection typically includes a local anesthetic such as 1% lidocaine. However, studies have called into question whether these local anesthetics are necessary. When educating patients about the potential complications of injection, providers often discuss the potential chondrotoxic effects and toxic tendinopathy associated with local anesthetics such as lidocaine. Several in vitro studies conducted with human-harvested Achilles and rotator cuff tendons have found that treatment with lidocaine or bupivacaine decreased the proliferation of tendon cells and extracellular matrix production through the downregulation of cyclin A and cyclin-dependent kinase 2 (CDK2), cell cycle regulatory proteins that are important for chondrocyte proliferation. It was also found that type I and IV collagen expression were downregulated in treatment groups.[13,14] While all local anesthetics have been shown to have some degree of chondrotoxic effects, some are relatively less chondrotoxic than others. Studies that reviewed in vitro and clinical studies have found that bupivacaine is the most chondrotoxic local anesthetic commonly used in clinical practice followed by lidocaine. Ropivacaine has been demonstrated in vitro and in clinical trials to be significantly less chondrotoxic than bupivacaine and

TABLE 1: Relative chondrotoxicity of local anesthetic agents

Most chondrotoxic	Levobupivacaine
	Bupivacaine
	Lidocaine
	Mepivacaine
Least chondrotoxic	Ropivacaine

lidocaine. Other less commonly used anesthetics were also analyzed. It was found that mepivacaine is more chondrotoxic than ropivacaine, but less chondrotoxic than bupivacaine and lidocaine. Furthermore, levobupivacaine was found to be even more chondrotoxic than bupivacaine (Table 1).[15] However, this anesthetic is less commonly used in clinical practice.

Despite the chondrotoxic effects of local anesthetics, they are often still included in most injections to reduce the pain experienced by the patient. This has led clinicians to investigate whether local anesthetics are effective in reducing injection pain, and other alternative options that may reduce pain associated with injection. Two double-blind, randomized, control trials were conducted to determine the efficacy of local anesthetic when treating TF. In the first study, the J-tip system, which uses compressed CO2 to propel medication into the subcutaneous tissue without a needle, was used to anesthetize the local area before administration of a corticosteroid injection. It was found that the pain experienced by the treatment group who received lidocaine before injection had a lower mean Visual Analogue Scale (VAS) pain score compared to the control group who received normal saline. However, this difference was not statistically significant.[16] Another study also investigated the efficacy of local anesthetics by comparing VAS scores among control and treatment groups. The treatment group received 1 mL of triamcinolone 40 mg and 1 mL of lidocaine with epinephrine, and the control group received an injection consisting of 1 mL of triamcinolone 40 mg and 1 mL of normal saline. It was found that VAS scores in the treatment group were significantly higher than those in the control group.[17] This study demonstrated that those who received simultaneous injections with corticosteroids and lidocaine perceived a higher level of pain compared to those who received corticosteroids with normal saline. These studies suggest that using local anesthetic in TF injections may not be necessary, but further studies must be conducted before strong conclusions can be drawn.

INJECTION TECHNIQUES: ULTRASOUND GUIDANCE AND ALTERNATIVE NEEDLE APPROACHES

One innovation that has changed the course of medicine has been the introduction of ultrasound (US) guidance and the increasing prevalence of US-guided procedures. Traditionally, intra-articular and other soft-tissue injections were performed using landmarks. However, US-guided injections have slowly become more commonplace in many practices as they increase the accuracy of injections and allow providers to see specific structures relevant to needle placement and manipulation. This increased accuracy has been demonstrated in cadaveric studies, which found that US guidance increased the accuracy of intrasheath injections into the flexor tendon sheath near the A1 pulley.[18] Studies have demonstrated that US provides increased accuracy for TF injections. However, studies have also shown that the increased accuracy does not necessarily lead to a significant improvement in clinical outcomes in the case of TF.

One of the main advantages of using US guidance when performing TF injections is that providers can visualize the needle entering the flexor tendon sheath. It was previously hypothesized that if a greater amount of steroid could be administered within the sheath, then clinical outcomes would improve. However, several studies comparing intrasheath vs extrasheath corticosteroid injections in the treatment of TF found no significant differences in clinical outcomes and injection into either space provides comparable symptomatic relief.[19,20] However, clinical studies comparing blind vs US-guided injection techniques have mixed results. One study demonstrated that those who received US-guided TF injections did not differ significantly from the blind group when comparing pain or the need for additional injections after initial treatment. It was concluded that US guidance only created extra effort and cost without increased clinical benefits.[21]. A recent study found that patients who received US-guided injections experienced greater symptomatic relief in the first 1 to 4 weeks and could return to activities faster than the blind group. However, there was no significant long-term difference when symptoms were reassessed at weeks 6 and 12.[22] Certainly, US-guided injections depend on various factors including physician skill, the type of machine, and other factors that can all affect clinical outcomes. Due to the mixed results of these studies, further repeat studies with larger sample sizes would be necessary to determine the efficacy of US in improving clinical outcomes for TF.

In addition to introducing US guidance to improve the accuracy of injections, various techniques have also been employed to increase accuracy while decreasing pain. Currently, the traditional injection technique for TF is a blind approach in which the needle is inserted on the palmar surface of the flexor tendon over the metacarpal head. Other alternative injection approaches utilized are the proximal phalanx and

midaxial techniques. The proximal phalanx technique approaches the flexor tendon sheath from the palmar surface at the midproximal phalanx, while the midaxial technique approaches the flexor tendon sheath perpendicularly. These techniques were hypothesized to be less painful than the traditional approach, as the palmar skin contains a high density of sensory receptors. Studies comparing these techniques found that the mixaxial and proximal phalanx approaches are less painful than conventional techniques. In addition to being less painful, it was also found that recurrence rates did not differ between these alternative approaches and conventional techniques.[23,24]

ALTERNATIVE INJECTIONS: ORTHOBIOLOGICS FOR THE TREATMENT OF TF

As the treatment of musculoskeletal injuries has progressed, orthobiologics such as platelet-rich plasma (PRP), stem cells, and hyaluronic acid have become more prominent. PRP effectively treats various pathologies such as rotator cuff tendinopathy, lateral epicondylitis, and patellar tendinitis.[25] However, PRP has not been widely studied and documented in treating TF or other hand pathologies. One case report details the experience of a 63-year-old female patient who was diagnosed with TF. Over 3 weeks, the patient received three PRP injections. The triggering had entirely resolved at their 3-month follow-up and the patient no longer experienced any pain. This study concluded that PRP injection may potentially be an effective treatment for TF.[26] While this case is largely preliminary, further follow-up studies would need to be conducted to establish PRP as a viable treatment option for TF. Another case report details the experience of a 38-year-old patient who underwent PRP therapy for the treatment of wrist flexor tenosynovitis. This patient received a 3-mL injection of PRP into the carpal tunnel. At the 6- and 12-week follow-up appointments, VAS and Quick Disabilities of Arm, Shoulder and Hand (Q-DASH) scores had improved compared to baseline.[27] While the pathophysiology of TF and flexor tenosynovitis follows similar mechanisms, the results of this case cannot necessarily be applied to the treatment of TF. Further case reports and control trials regarding PRP for treating TF are necessary to establish the efficacy of this treatment modality.

Currently, there is only anecdotal evidence that discusses using PRP for treating TF. However, research in the field is growing. In 2020, a study protocol for a randomized control trial was registered and published in BMC. The protocol details a prospective, randomized, triple-blind, placebo-controlled trial that will compare the efficacy of PRP vs corticosteroid. To measure treatment outcomes, the investigators plan on using Patient Rated Wrist Evaluation (PRWE), Q-DASH, and VAS scores over 6 months. At the time of publication, the trial was in the recruitment phase and the results have yet to be published.[28] However, this protocol is the first of its kind and helps lay the groundwork for further research regarding the use of PRP for treating TF. Because there is only anecdotal evidence at this time, a randomized control trial will greatly benefit the field and help establish the efficacy of PRP compared to other injectate options. Furthermore, this protocol will benefit other investigators aiming to replicate or conduct similar randomized control trials regarding the use of PRP.

Hyaluronic acid has also been studied for use in the treatment of TF. Hyaluronic acid is an effective treatment option for musculoskeletal injuries, specifically soft-tissue injuries such as shoulder, elbow, and ankle tendinopathies.[29] One study uses hyaluronic acid injection in conjunction with methylprednisolone to treat TF. It was hypothesized that the hyaluronic acid would act as a mechanical intermediary that would aid in restoring synovial fluid viscosity, thus enlarging narrowed tendon sheaths. In conjunction with a corticosteroid, these properties would allow for optimal tendon gliding and patient recovery. Fifteen patients received a combination of hyaluronic acid and methylprednisolone, and 14 reported a complete resolution of symptoms at the 6-month follow-up.[30] This study has several limitations including a small sample size and the fact that it does not compare the hyaluronic acid group to a corticosteroid monotherapy group. Therefore, further studies would need to be conducted to establish the effect hyaluronic acid has on the treatment of TF.

Orthobiologics are becoming a high-profile option for treating musculoskeletal pathologies, but limitations exist. The cost of these treatments has led clinicians and investigators to investigate the cost-efficacy of these alternative injectate options. While many alternative injectate options can be a potentially promising avenue for the treatment of TF, the cost variability of orthobiologic treatments, such as PRP, may be a limiting factor for patient access.[31] One study conducted regarding the use of PRP for lateral epicondylitis showed that it was a more cost-effective option when compared to surgery and corticosteroid injections.[32] However, the study did not include a cost-benefit analysis of other upper-extremity disorders, so the conclusions may not apply to the treatment of TF. Currently, there are no cost-benefit analyses for using PRP or other orthobiologics for treating TF, which would be necessary to determine if this is a viable treatment recommendation for most patients.

RISKS OF TF INJECTION

Generally, traditional injections with corticosteroids and local anesthetic are considered very safe for most patients. While it is thought that these injections are less effective among those with diabetes mellitus, or

a history of multiple injections, the risks are mostly identical. The most common adverse effects of TF injection include local skin hypopigmentation, dermal atrophy, fat atrophy, infection, and pain at the injection site. For patients with diabetes, there is also a risk of a transient increase in serum glucose. The most serious complication of injection, while incredibly rare, is tendon rupture.[1] One case report details the rupture of the flexor digitorum profundus (FDP) tendon following the injection of insoluble corticosteroid for the treatment of TF.[33] While this is an infrequent complication, cases have been documented and surgical intervention is required to correct the rupture.[34]

CLINICAL IMPLICATIONS AND AVENUES FOR FURTHER RESEARCH

The studies reviewed above leave much room for further study regarding the treatment of TF. Currently, standard practice for the injection of TF includes the use of corticosteroids and a local anesthetic like lidocaine. However, the chondrotoxic effects of lidocaine and other anesthetics can be concerning for both the patient and the provider. Studies have demonstrated that the use of local anesthetics in TF injections does not necessarily decrease perceived pain. The implications of this study have the potential to change the standard of practice. However, this would require more robust studies and clinical trials to be conducted so providers have a wider base of literature to draw evidence-based practice conclusions from.

Current literature also leaves much room for further studies regarding the costs and benefits of various treatment options. While patient costs can vary from practice to practice, insurance providers, and other factors, literature has shown that traditional corticosteroid injection is one of the more cost-effective options for treating TF, followed by surgical release. However, other injectate options, such as PRP and orthobiologics, have become more high-profile and readily accessible. Further studies would need to be conducted to determine the efficacy of these treatment options, and cost-benefit analyses would be necessary to determine if they are viable treatment options that can be recommended to patients.

In addition to the types of injectate agents used for the treatment of TF, further studies need to be conducted regarding various injection techniques, specifically those done under US guidance. Currently, literature has shown mixed results regarding the long-term outcomes for patients who received TF injections with and without US guidance. Some studies have found that US-guided injection provides no significant benefits, while others have found that using US guidance improves early patient outcomes. Due to these mixed results, repeat studies with larger sample sizes and stringent control measures would benefit the area of study.

While the cause of the initial inflammation that leads to TF is still unclear, the study of potential prevention methods, such as rest, or osteopathic manipulative treatment (OMT), could be beneficial additions to the pool of current literature, as studies regarding TF prevention are not widely documented. Currently, there is only anecdotal evidence in the form of a case study that discusses the successful treatment of TF using OMT in conjunction with acupuncture. However, OMT could be beneficial in preventing TF or potentially decrease the need for repeat injections. Techniques such as myofascial release and carpal articulation are effective treatment methods for other pathologies, and these principles may be applicable in treating TF. Larger studies that look into various osteopathic techniques for the treatment or prevention of TF could be beneficial for the field and osteopathic medicine as a whole.

At this point, the mainstay treatment for TF remains symptomatic management with NSAIDs, splinting, corticosteroid injection, and surgical release. For those with symptomatic TF that is not responding to conservative treatment options, corticosteroid injection, and surgical release remain options. As previously stated, further research regarding the use of local anesthetic in these injections requires further investigation. However, as the use of local anesthetic in corticosteroid injections is commonplace, it may be worthwhile to consider using a relatively less chondrotoxic anesthetic agent such as ropivacaine. Further cost-benefit analyses and studies regarding the efficacy of percutaneous vs open TF release would benefit providers making referrals for surgical release.

AN OSTEOPATHIC PERSPECTIVE

The importance of rational treatment has been a mainstay of the osteopathic practice. When considering the treatment of TF, the family physician is likely the first provider a patient may see. A wide variety of treatment options is available, and how one goes about treating this pathology can differ based on a wide variety of patient factors. As family physicians, being aware of current TF practices and the innovations yet to come will help physicians be better equipped and provide more individualized care for their patients.

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