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REVIEW

The Role of Conservative Treatment in Ulnar Nerve Entrapment at the Elbow

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Abstract

Ulnar neuropathy at the elbow (UNE), is a condition characterized by the compression of the ulnar nerve in the elbow region. It typically presents with symptoms such as pain, numbness, and weakness. Conservative treatment methods include patient education, activity modification, exercise, physical therapy modalities, splinting, injections, and oral medications. These conservative treatments aim to improve nerve function and reduce pain. One of the most prominent approaches in the literature is splinting, which helps alleviate symptoms by reducing mechanical pressure on the elbow, while other physical therapy modalities contribute to pain control and inflammation management, enhancing the patient's functionality. The potential of conservative treatments to decrease the need for surgical intervention and improve patients' quality of life is significant. In conclusion, conservative treatment methods for cubital tunnel syndrome (CuTS) offer valuable options for managing symptoms and enhancing overall functionality. This review aims to examine the role, effectiveness, and application strategies of conservative approaches in the treatment of UNE.

Keywords: Ulnar nerve entrapment, physical therapy modalities, nerve mobilization, splinting.

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INTRODUCTION

Ulnar neuropathy at the elbow (UNE) is the second most common entrapment neuropathy of the upper extremity, following carpal tunnel syndrome (CTS). It typically occurs due to compression or traction of the ulnar nerve at the elbow, most commonly at the epicondylar groove or cubital tunnel (1). UNE predominantly affects individuals aged 40 to 60 years and more frequent involvement of the non-dominant elbow (2,3). UNE is more common in men, particularly those working in occupations that involve repetitive hand or arm movements. This gender difference may be influenced by anatomical and biomechanical factors (2). The pathophysiology of UNE is primarily attributed to repetitive flexion and extension movements, which elevate intraneural pressure and induce mechanical compression. Studies have shown that with every 45-degree increase in elbow flexion, the pressure within the cubital tunnel rises significantly (4). Prolonged compression can lead to demyelination, impaired nerve conduction, and axonal injury, contributing to progressive neuropathy. Other contributing factors include space-occupying lesions (e.g., ganglion cysts, lipomas, tumors), previous fractures, and congenital anomalies (5). Additionally, an increased carrying angle has been proposed as a risk factor for nontraumatic UNE (6). Repetitive flexion-extension movements and prolonged elbow flexion increase the risk of UNE. Occupations such as plumbing, carpentry, tailoring, painting, asphalt and concrete work, driving, and roofing have been associated with a higher prevalence of the condition (7,8).

Clinically, patients often present with paresthesia, numbness, and pain along the ulnar aspect of the hand, particularly affecting the fourth and fifth fingers. In advanced cases, atrophy of the hypothenar and thenar muscles including the ulnar-innervated adductor pollicis (AP) and the deep head of the flexor pollicis brevis (FPB) may be observed (9). In moderate to severe cases, weakness of the third and fourth lumbrical muscles can lead to claw hand deformity, characterized by hyperextension at the fourth and fifth metacarpophalangeal (MCP) joints and flexion at the interphalangeal (IP) joints (5,10). Characteristic clinical signs include Wartenberg's sign, Froment's sign, and Jeanne's sign, which indicate ulnar nerve dysfunction. To confirm the diagnosis, provocative tests (e.g., Tinel's sign, elbow flexion test, ulnar nerve compression test) are commonly used, along with electrophysiological studies, which help determine the severity and site of nerve entrapment (11,12) (Figure 1.). Unequivocal sensory loss over the medial dorsal aspect of the hand and fingers and/or weakness of the distal flexors of the ring and little fingers are consistent with a lesion at the elbow, not at the wrist. However, in mild or early cases of UNE, these signs may not be present (13).

Electrodiagnostic studies (EDx) are essential for diagnosing UNE, identifying the entrapment site, and assessing neuropathy severity. These tests help differentiate UNE from conditions such as plexopathy, radiculopathy, and polyneuropathy. Common findings include slowed conduction velocity, focal demyelination, or conduction block (14). In clinical cases of UNE, EDx have been reported to have a sensitivity of 63.3% and a specificity of 87.9% (15). However, newer diagnostic modalities such as ultrasound and magnetic resonance neurography (MRN) have demonstrated superior sensitivity and specificity in certain cases (16). Carroll et

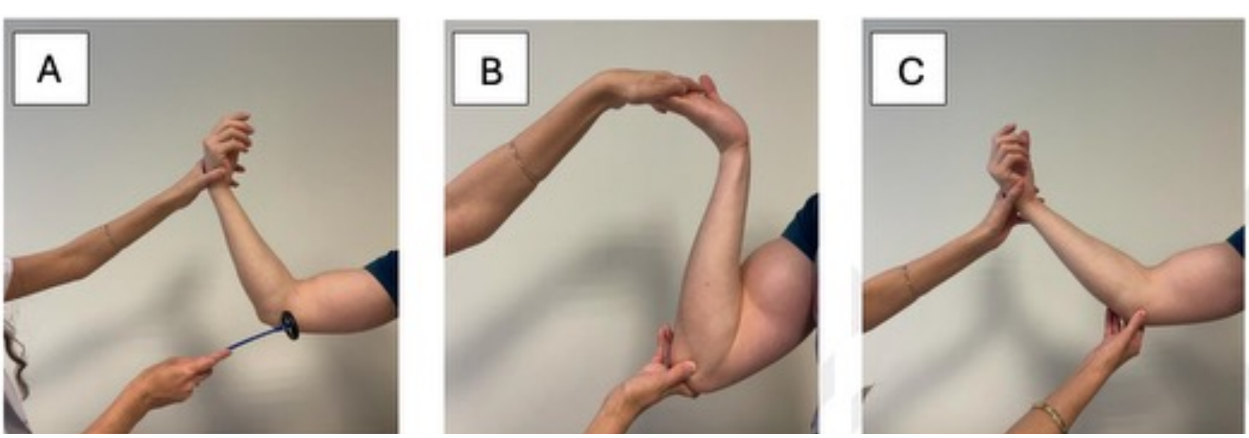

Figure 1: A. Tinel's sign B. Elbow flexion test C. Ulnar nerve compression test

al. demonstrated that ultrasound is not only a reliable alternative to EDx but also effective in detecting early-stage UNE in patients with negative electrodiagnostic findings, achieving a diagnostic accuracy of up to 94.8% (17). MRN, particularly diffusion tensor imaging (DTI)-based MRN, has been reported to provide better anatomical resolution and diagnostic performance for UNE compared to conventional nerve conduction studies (NCS) (18). Additionally, magnetic resonance imaging (MRI) has demonstrated higher sensitivity (90%) compared to EDx (65%) in diagnosing UNE (19). Ultrasonographic cross-sectional area (CSA) measurements of the ulnar nerve have also been shown to correlate with UNE severity, with CSA-max ≥10 mm^2 being a strong indicator of severe cases (sensitivity 82%, specificity 72%) (20). Given these findings, ultrasound, MRN and MRI serve as valuable complementary tools in UNE diagnosis, particularly when electrodiagnostic assessments yield inconclusive results.

Conservative management is generally preferred as the first-line treatment to delay or prevent surgical intervention (21). This includes patient education, activity modification, splinting, physical therapy, and pain management strategies (4,22). The present review explores the efficacy, mechanisms, and clinical applications of conservative treatment approaches in the management of UNE.

TREATMENT APPROACHES

The primary goal of treatment for UNE is to reduce or eliminate pressure on the ulnar nerve and prevent further nerve damage. In cases of severe UNE, structural anomalies, or trauma, surgical intervention may be the primary treatment option to prevent axonal damage and muscular atrophy (23). Surgical intervention should also be considered for patients who have persistent symptoms lasting at least six months, those unresponsive to conservative treatments, or those exhibiting progressive clinical findings such as muscle atrophy, hand deformities, or worsening electrophysiological test results (24–26). Conversely, conservative management remains the first-line approach in patients with mild to moderate symptoms, no motor deficits, and normal electroneuromyography findings, particularly in early-stage UNE (4). Non-surgical interventions such as patient education, activity modification, nerve mobilization exercises, splinting, physical therapy modalities, injections, and oral pharmacological treatments can be used individually or in combination, depending on symptom severity (23). A 2023 meta-analysis by Natroshvili et al. reported that 90% of patients with UNE experienced symptom improvement following conservative treatment (27). However, for those who do not respond to these interventions, surgical options, including ulnar nerve decompression, anterior transposition, or medial epicondylectomy, remain the definitive treatment strategies. Early consultation with a physician is crucial to determine the most appropriate treatment plan and to prevent further progression of the condition (24).

CONSERVATIVE TREATMENT

Patient Education and Activity Modification

Avoiding movements that exacerbate symptoms is crucial in the management of UNE. Patients should be educated on why these movements should be avoided, along with an explanation of the underlying pathophysiology. Activities that involve medial pressure on the elbow, repetitive flexion and extension, flexing the elbow beyond 90° outside of essential daily activities, or prolonged nerve stretching due to elbow flexion combined with wrist extension in an elevated arm position should be minimized (28). Studies have shown that maintaining the elbow at an optimal position of 45° reduces nerve compression in UNE (22,29). Research suggests that keeping the elbow at 45° of flexion, the forearm in a neutral position (midway between pronation and supination), and the wrist in slight extension may help minimize nerve compression in UNE. (22,30). Special attention should be given to individuals who work at a desk and frequently use a computer keyboard, as improper elbow positioning can exacerbate symptoms (31). To assist with maintaining the correct posture, a goniometer adjusted to 45° can be used to guide patients on how to hold their elbow in an optimal position. For patients who tend to sleep with their elbows flexed, especially those who experience morning paresthesia or symptoms during the night, using a simple support, such as a towel or bandage, can help restrict excessive elbow flexion (32). These strategies serve as reminders for patients to maintain appropriate elbow positioning, thereby reducing pressure on the nerve. Additionally, providing an educational brochure outlining proper positioning techniques and recommended exercises may enhance patient adherence to activity modifications (22,28).

A study by Beekman et al. comparing conservative and surgical treatment in patients with cubital tunnel syndrome (CuTS) demonstrated that conservative management through patient education and activity modification can yield effective outcomes. After six months of treatment, 35% of patients showed symptom improvement, while 11% achieved complete remission (33). Nakamichi et al. reported that 59% of affected arms showed symptom relief within three months following education on pathophysiology and activity modification (28). Additionally, Omejec et al. found that 82% of patients experienced symptom improvement after an average period of 22.8 months of avoiding risky positions of the affected limb (34). Furthermore, Padua et al. described that 40% of patients improved within 6 to 19 months after receiving education on UNE and ergonomic modifications. These findings highlight that conservative treatment is a viable and effective option, particularly in early-stage UNE, and should be considered as an alternative to surgery in appropriately selected patients (35).

Splinting

Splinting is a fundamental component of conservative treatment for UNE. Night splints can be used to maintain the elbow at 40–50° of flexion, where the ulnar nerve experiences the lowest average intraneural and extraneural pressure (36). While Hong et al. recommended limiting elbow flexion to 35°, other studies have suggested an optimal limit of 45° (31,37).

In a prospective 8-year study conducted by Dellon et al. involving 128 patients with varying degrees of UNE severity, conservative treatment was applied for six months, including patient education and night splinting with elbow flexion restricted to 30°. The results showed that 42% of mild, 34% of moderate, and 20% of severe cases became asymptomatic. Notably, no correlation was found between abnormal electrophysiological test results and clinical improvement failure, suggesting that splinting may be effective even in severe cases (26). Similarly, Shah et al. followed 25 patients with mild to moderate UNE who underwent patient education and night splinting at 45° of flexion for three months. At the end of the follow-up period, 88% of patients showed clinical and functional improvement, with sustained benefits reported for two years. Additionally, night splinting was well tolerated by patients (38).

Studies generally recommend night splinting for UNE rather than continuous daytime use (21,38,39). Shah et al. and Svernlöv et al. specifically suggested a splinting duration of three months, while Seror et al. applied splinting for six months (21,38,39). In contrast, Çelik et al. used splinting for a shorter duration of three weeks. Their findings indicated that after three weeks of night splinting, VAS pain scores showed a reduction both at night and during the day by the 15th day and at three months (40). However, no study has directly compared different splinting durations to determine the optimal treatment period. Furthermore, there is a lack of comparative studies evaluating whether night-only splinting differs in efficacy from full-time use.

Splints can be made from various materials, including neoprene, polyform, and thermoplastic. In cases of persistent pain and paresthesia, rigid thermoplastic splints that maintain the elbow at 45° flexion throughout the day may be recommended (36). The duration of splint use varies based on symptom severity, ranging from three weeks to six months (21,37). Studies have employed different splinting materials, such as neoprene with an aluminum insert and thermoplastic molded splints , but there is no direct comparative study evaluating the superiority of one splint type over another in terms of ulnar nerve compression (21,41). The choice of splint may depend on patient tolerance, severity of symptoms, and clinician preference.

Taping Methods

Taping techniques, particularly kinesiotaping (KT), have gained popularity as a complementary approach in the management of musculoskeletal and neurological conditions (42). This method is primarily used to alleviate pain and improve functional outcomes by enhancing blood and lymphatic circulation, increasing proprioceptive input, and facilitating muscle activation (42). Although KT is often applied in conjunction with other therapeutic interventions, studies suggest that it provides short-term benefits in reducing pain intensity and improving joint mobility, strength, and overall functionality (43).

In the context of neuropathic conditions, KT has shown potential benefits in various nerve entrapment syndromes, including radial nerve entrapment, diabetic neuropathy, and meralgia paresthetica (44–46). While there is substantial evidence regarding its use in median nerve conditions, such as CTS, limited research is available on its effectiveness in UNE (43). A case report by Illes et al. described the use of elastic therapeutic taping in a patient with CuTS, hypothesizing that it may reduce compression along the ulnar nerve path by modulating muscle tone and improving lymphatic drainage. The proposed mechanism suggests that the elasticity of the tape creates a mild shearing force on the underlying fascia, potentially alleviating ischemic compression at the entrapment site. In this study, KT was found to reduce VAS numbness scores and lead to a negative Tinel test after treatment (47). However, the exact physiological effects remain unclear, and further studies are needed to elucidate its role in UNE treatment.

Despite the lack of high-quality evidence, KT remains an accessible, low-cost, and easy-to-apply intervention that may serve as an adjunct to conventional treatments for UNE. Future research should focus on systematically evaluating its long-term efficacy and defining standardized application protocols tailored to ulnar nerve pathologies.

Exercise Interventions

Nerve gliding exercises are commonly used in the treatment of upper extremity entrapment neuropathies. Their primary goal is to enhance nerve mobility and reduce surrounding mechanical pressure (48). However, there is variability in opinions regarding their efficacy and proper application (49). The frequency and duration of these exercises vary across different sources, and proper instruction is essential for effective implementation.

In a protocol described by Svernlov et al., known as the Philadelphia program, ulnar nerve gliding exercises are performed in six different positions, with each position held for 30 seconds and repeated three times. A one-minute rest is allowed between each repetition. Initially, the exercises are performed twice daily and progressively increased to three times per day, provided that symptoms do not worsen (21).

Coppieters et al. introduced sliding and tensioning techniques for ulnar nerve mobilization. In the sliding technique, the ulnar nerve undergoes loading when the wrist is extended, while elbow extension relieves the tension (unloading). Conversely, when the elbow is flexed, the nerve is loaded, and wrist flexion unloads it. These movements are performed alternately, facilitating gentle nerve gliding. In the tensioning technique, sequential movements are performed to apply controlled stress on the nerve and brachial plexus (50). These movements and the associated pressure variations are thought to facilitate the release of intraneural and extraneural fluids, potentially counteracting increased pressure, enhancing axonal transport, and improving nerve conduction (48).

Nishide et al. applied repetitive passive wrist movement at maximal elbow flexion to enhance ulnar nerve gliding, with sessions held twice weekly for an average of 5.8 months. Their study demonstrated significant improvements in paresthesia severity, positive elbow flexion test rates, sensory function, grip and pinch strength, and motor and sensory nerve conduction velocities (NCV) in most patients. These findings suggest that ulnar nerve gliding exercises can be beneficial in non-surgical management, although they may not be effective in severe cases, where surgical intervention might be required (51).

Recent studies have demonstrated that nerve gliding techniques produce distinct mechanical effects on the peripheral nervous system (52,53). The sliding technique allows for greater nerve excursion compared to the tensioning technique (8.3 mm vs. 3.8 mm) while minimizing strain (54). This method facilitates nerve movement without excessive elongation, making it a safer and more suitable option for acute injuries, post-operative rehabilitation, and conditions involving nerve irritation or entrapment (52,54). Additionally, sliding techniques have been proposed to aid in the dispersal of inflammatory products, prevent excessive scar formation, and promote neural adaptation by integrating pain-free movement patterns, potentially improving sensorimotor representation in patients with neuropathic conditions (55).

Clinical studies suggest that these techniques may have a cumulative effect on the nervous system. While nerve gliding exercises may alleviate symptoms, their effectiveness likely depends not only on the nerve itself but also on its interactions with surrounding structures (56).

Currently, nerve mobilization exercises are the most extensively studied approach for UNE, and no alternative exercise interventions have demonstrated superior effectiveness in the literature. Therefore, further research is needed to explore and validate other potential exercise interventions for UNE management.

Manual Therapy

Manual therapy techniques, including soft tissue mobilization and joint mobilization, have been explored as non-surgical interventions for peripheral nerve entrapments (57). Studies suggest that chiropractic and osteopathic manipulations may help relieve mechanical compression on the median nerve, potentially reducing symptoms by improving soft tissue mobility, carpal bone alignment, and nerve gliding (58–60). In an open trial, patients with CTS who underwent soft tissue mobilization three times per week for two weeks experienced improvements in pain, paresthesia, and hand function, although electrophysiological findings remained unchanged (61). Similarly, Bongi et al. highlighted that manual therapy can be an effective non-surgical approach, particularly in patients who are awaiting surgery, unwilling to undergo surgery, or have comorbidities that limit surgical options (57). Although the current literature primarily focuses on CTS, the theoretical principles of manual therapy suggest that similar soft tissue and joint mobilization techniques may also benefit UNE. By reducing mechanical restrictions, improving neural mobility, and enhancing local circulation, manual therapy may serve as a valuable adjunct to conservative treatment strategies for UNE.

Physical Therapy Modalities

Thermal Modalities

Thermal modalities, including cold and heat applications, are widely utilized as adjunctive therapies for neuropathic conditions due to their effects on circulatory dynamics, tissue elasticity, and pain modulation (62). While cold therapy (cryotherapy) is primarily used in the acute inflammatory phase to reduce edema, swelling, and nerve excitability, heat therapy enhances blood flow, NCV, and pain relief via mechanisms such as vasodilation, endorphin release, and mechanical stress reduction on nerve endings (63). Several studies have investigated the efficacy of thermal modalities in median nerve entrapment syndromes, particularly CTS (64,65). Michlovitz et al. demonstrated that continuous low-level heat wraps (40°C for 8 hours per day for three consecutive days) resulted in significant improvements in pain, functional status, and grip strength in CTS patients (66). Similarly, Laymon et al. examined the effects of hot and cold packs, showing that applying heat for 60–120 minutes or cold for 20 minutes led to physiological changes that could potentially alleviate nerve compression and symptoms (65). Additionally, cryotherapy has been suggested to reduce compression of the carpal ligament and nerve, providing relief in CTS. However, current literature lacks direct evidence on the efficacy of thermal modalities in UNE. Given the similarities in pathophysiology between CTS and UNE, it is plausible that cold and heat applications may offer comparable benefits in reducing symptoms and improving function in UNE. Despite the absence of targeted research, thermal modalities remain a low-cost, non-invasive adjunct that may be considered in the conservative management of UNE.

Ultrasound Therapy

Ultrasound therapy exerts physiological effects by generating vibrations through the absorption of high-frequency sound waves in tissues. This therapy has both thermal and non-thermal effects, each contributing to its therapeutic benefits. The thermal effect increases tissue elasticity, enhances blood flow, modulates pain, and reduces joint stiffness. Meanwhile, the non-thermal effect utilizes mechanisms such as cavitation, acoustic streaming, and micromassage to stimulate tissue regeneration, facilitate soft tissue healing, and promote bone repair (67) . Ultrasound therapy is widely used in the management of musculoskeletal pain syndromes and is believed to aid in the recovery of nerve entrapments by promoting nerve regeneration and conduction (68).

In a study by Özkan et al., continuous-mode ultrasound therapy was applied five times per week for two weeks, using a 5 cm² transducer area, 1 MHz frequency, and 1.5 W/cm² intensity for 5 minutes per session. At the 1st and 3rd months, the ultrasound -treated group demonstrated reduced pain scores, improved grip strength, enhanced sensory test results, and positive electrophysiological changes. These findings suggest that ultrasound therapy may contribute to early pain management and functional recovery (69).

Oskay et al. investigated the effects of a multimodal rehabilitation program, including pulsed ultrasound, in seven patients with CuTS. The study evaluated pre- and post-treatment changes within the same group. The treatment protocol, applied three times per week for eight weeks, included pulsed ultrasound (25% intensity, 1 W/cm² for 5 minutes over the ulnar nerve pathway), nerve gliding exercises, cold application, strengthening exercises, and ergonomic modifications. Pain, Tinel's sign, and Disability of Arm, Shoulder, and Hand Index scores improved, while grip and pinch strength increased. The study suggests that combining pulsed ultrasound with other conservative treatments may enhance functional outcomes in CuTS (70).

The literature suggests that ultrasound therapy is effective in managing UNE, particularly in reducing pain and improving functional outcomes. However, studies comparing ultrasound alone to its combination with other conservative treatments are limited. While both studies support the therapeutic potential of ultrasound, further research is needed to determine whether ultrasound alone or in combination with other conservative approaches provides superior outcomes in UNE management (69,70).

Shortwave Diathermy

Shortwave diathermy (SWD) is a high-frequency current therapy that increases deep tissue temperature by converting electromagnetic energy into thermal energy. It operates in continuous and pulsed modes, each producing distinct physiological effects. The continuous mode generates thermal effects, leading to increased cell metabolism, blood flow, and tissue elasticity while also facilitating muscle relaxation and enzyme reactions due to the rise in temperature (71). The pulsed mode, on the other hand, exerts non-thermal effects, which contribute to wound healing and edema reduction by influencing cellular processes without causing significant heat accumulation (72).

Systematic reviews on the efficacy of SWD in peripheral neuropathy indicate that SWD, when applied at a frequency of 27.12 MHz for 15 minutes daily over three weeks, can lead to increases in the number of myelinated nerve fibers, myelin sheath thickness, and axonal diameter, as well as improvements in electrophysiological parameters and motor function (73).

In a double-blind, randomized, sham-controlled study by Badur et al., the effects of SWD were evaluated in patients with mild to moderate UNE. SWD was applied at 27.12 MHz in continuous mode for 20 minutes per session, five times per week for two weeks, targeting the elbow region. Both groups received patient education and splinting, and clinical and functional outcomes were assessed at two weeks, one month, and three months. The results showed similar improvements in both groups, with no significant difference between the SWD and control groups. This suggests that symptom improvement may have been primarily due to splinting and patient education, rather than the applied SWD protocol (74).

To accurately assess the efficacy of SWD in UNE, future studies with larger sample sizes, longer follow-up periods, and different SWD protocols are needed.

Low-Level Laser Therapy

The primary mechanism of laser therapy involves increasing the rotation speed of electrons in atoms, generating a new beam of light as photon energy is emitted from the light source (75). The fundamental effect of low-level laser therapy (LLLT) is tissue stimulation, which induces photochemical reactions in cells, interstitial tissue, blood vessels, and the immune system, exerting a biostimulatory effect (76). Its analgesic properties stem from its ability to increase endogenous endorphin release, reduce muscle arteriole spasms, and induce reactive vasodilation, ultimately elevating the pain threshold (77). Additionally, LLLT exerts anti-inflammatory effects by inhibiting cyclooxygenase-2 (COX-2) activity and reducing prostaglandin E2 levels. Moreover, it has been shown to stimulate collagen fiber and cell proliferation, activate angiogenesis, and accelerate tissue healing (78). LLLT has significant effects on neural tissue, as studies suggest that it enhances nerve regeneration and conduction, mitigating the effects of nerve compression and promoting recovery through its biophysical mechanisms (79).

There is currently no consensus on the type of laser, treatment duration, or wavelength parameters used in clinical applications. In a double-blind, randomized, sham-controlled trial, Çelik et al. evaluated the efficacy of LLLT in UNE patients. The treatment was applied at 808 nm wavelength in continuous mode, with a dose of 2 J/cm², administered at five points for 60 seconds per point over 15 sessions. The study compared LLLT to a sham laser treatment. Post-treatment evaluations showed significant improvements in symptoms, clinical findings, and electrophysiological parameters in the LLLT group compared to the sham group, suggesting its potential role in UNE management (40).

Similarly, in a study comparing LLLT and ultrasound in UNE patients, Özkan et al. applied LLLT at a 905 nm wavelength, with a dose of 0.8 J/cm² in continuous mode, delivering 30-second treatments at four points over 10 sessions. At the third-month follow-up, the LLLT group exhibited significant improvements in grip strength and latency changes in electrophysiological assessments (69).

In another sham-controlled study, Suganthirababu et al. investigated LLLT at a 904 nm wavelength and 4.0 J/cm² intensity in continuous mode. The laser was applied for 20 seconds at a single point over the ulnar nerve, behind the medial epicondyle of the humerus. Electrophysiological analysis demonstrated positive effects on amplitude and latency values, but there was no significant difference in conduction velocity between the sham and LLLT groups (80).

These findings suggest that LLLT may promote nerve regeneration and enhance conduction, thereby mitigating the effects of ulnar nerve compression. Consequently, LLLT may be considered a valuable alternative among conventional treatment methods for UNE.

High Intensity Laser Therapy

Laser therapy is classified into low-intensity and high-intensity categories based on the power used. If the power is below 500 mW, it is considered LLLT while power above 500 mW is classified as high-intensity laser therapy (HILT) (81). HILT employs high-powered pulsed neodymium-doped yttrium aluminum garnet (Nd-YAG) lasers and is a non-invasive regenerative treatment modality (82). The therapeutic effects of HILT depend on the penetration and absorption of photon energy delivered to the nerve and the affected areas. It is believed that HILT allows photons to penetrate deeper, potentially contributing to accelerated repair processes (83). A prospective, randomized controlled study by Hojjati et al. compared the effects of HILT, LLLT, and a control group in patients with CTS. The study, involving 45 patients, demonstrated improvements in pain severity, function, pinch strength, and nerve conduction parameters across all groups. Notably, laser therapy produced significantly better results compared to wrist splints; however, no significant differences were found between HILT and LLLT groups in terms of pain reduction, function, and pinch strength. Similarly, NCS results did not show significant differences between the groups (84). Additionally, El-Keblawy et al. conducted a randomized clinical trial investigating the effects of HILT in patients with CuTS. Thirty participants were randomly assigned to a HILT group and a placebo group, each receiving 20 treatment sessions over four consecutive weeks. Outcome measures included the Visual Analog Scale (VAS) and NCS assessed before and after the intervention. The findings demonstrated significant improvements in both pain reduction and ulnar NCV in the HILT group, whereas the placebo group exhibited improvements in pain only. These results suggest that HILT may serve as an effective treatment modality for CuTS (85). However, further comprehensive studies are needed to clarify the effectiveness of HILT, given the existing gaps in the literature and the lack of relevant studies on this topic.

Extracorporeal Shock Wave Therapy

Extracorporeal shock wave therapy (ESWT) is a non-invasive modality widely utilized in the management of various musculoskeletal conditions, including calcific tendinitis, lateral epicondylitis and plantar fasciitis. Its proposed biological mechanisms include promoting neurogenesis, angiogenesis, and anti-inflammatory responses, alongside stimulating the release of growth factors and activating progenitor and stem cells (86). Additionally, ESWT has been implicated in facilitating axonal regeneration, schwann cell proliferation, and macrophage activation during myelin debris clearance, which are crucial processes in nerve repair (87).

In a pilot study conducted by Shen et al., ESWT was applied to seven patients (10 elbows) diagnosed with moderate CuTS. The treatment protocol consisted of three sessions of radial ESWT (2,000 pulses, 4 Bar, 5 Hz) administered once weekly over the proximal cubital tunnel region. Clinical outcomes were assessed using the VAS and the Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire at the 4th, 8th, and 12th weeks following the final session. The study reported significant improvements in both VAS and QuickDASH scores across all follow-up periods. These preliminary findings suggest that ESWT may be a promising non-surgical intervention for moderate CuTS, providing symptom relief and functional improvement. However, further large-scale, randomized controlled studies (RCTs) are necessary to establish its long-term efficacy and optimal treatment protocols (88).

Local Injections

Evidence regarding the role of local injections in the treatment of UNE remains inconclusive. While corticosteroid injections are widely used to reduce inflammation and edema in peripheral nerve entrapment syndromes, their efficacy in UNE is not well established (89). Studies have reported conflicting results, with some demonstrating short-term symptomatic relief and others showing no significant long-term benefits. Choi et al. observed improvements in pain (VAS), ulnar nerve CSA, and NCS at four weeks following the administration of 40 mg triamcinolone acetonide combined with 2 ml of 1% lidocaine using an in-plane ultrasound-guided technique (90) . Similarly, Chen et al. found both corticosteroid and dextrose 5% injections to be equally effective, suggesting dextrose as a safer alternative with fewer adverse effects (91). However, VanVeen et al. reported no significant differences between corticosteroid and placebo groups at the three-month follow-up, highlighting the need for further investigation (89). Beyond corticosteroids, platelet-rich plasma (PRP) has emerged as a potential treatment option. In a study by Naggar et al., ultrasound-guided deep perineural PRP and corticosteroid injections were both found to be safe and effective for mild to moderate UNE, with PRP showing superior long-term nerve healing potential. The authors suggested that PRP may be more beneficial for milder cases of UNE (92).

Ultrasound guidance plays a crucial role in enhancing the precision and safety of peripheral nerve injections. It not only improves diagnostic accuracy but also ensures the correct placement of the injectate, minimizing complications such as intraneural injection or scarring (93,94).

Oral Pharmacological Treatments

Oral pharmacological treatments in UNE may contribute to symptom relief; however, they do not constitute the primary component of treatment. The use of oral medications depends on the severity of clinical findings and the underlying etiology and is generally considered a supportive option within conservative management.

Similar to corticosteroid injections, the efficacy of nonsteroidal anti-inflammatory drugs (NSAIDs) in UNE remains controversial, with conflicting reports in the literature regarding their therapeutic benefits (4). In cases of traumatic nerve compression, NSAIDs may be preferred to suppress inflammation and manage pain. In the presence of neuropathic pain symptoms, medications such as tricyclic antidepressants (TCAs), serotonin-norepinephrine reuptake inhibitors (SNRIs), and gabapentinoids can be used as part of symptom management (95).

Future Research Directions

Despite advancements in the diagnosis and management of UNE, several gaps remain in the literature. High-quality RCTs are needed to assess long-term outcomes of conservative treatments and determine optimal treatment strategies. The effectiveness of emerging therapies, such as ESWT, PRP, injections, and HILT, requires further investigation. Additionally, the ideal splinting duration and type remain uncertain, necessitating comparative studies. Furthermore, more robust clinical research is needed to establish standardized treatment protocols and improve patient outcomes.

CONCLUSION

Conservative treatment plays a crucial role in the management of UNE, particularly in mild to moderate cases. Among the available methods, patient education, activity modification, and splinting demonstrate the strongest evidence for symptom relief and functional improvement. Studies suggest that splinting at 40–50° elbow flexion, combined with patient education, provides long-term benefits and prevents symptom progression, especially in early-stage UNE (38,96).

Exercise-based interventions, particularly nerve gliding techniques, show promise in improving nerve mobility and reducing mechanical stress. However, their effectiveness varies depending on technique selection (sliding vs. tensioning), frequency, and patient compliance (48,50,51). While nerve mobilization remains the most widely studied exercise intervention for UNE, no alternative exercise strategies have demonstrated superior effectiveness. Further research is necessary to explore additional therapeutic exercises and validate their clinical efficacy.

Physical therapy modalities, such as ultrasound therapy and LLLT, have demonstrated short-term improvements in pain and electrophysiological parameters, but their long-term efficacy remains uncertain. Ultrasound therapy, whether alone or in combination with other conservative methods, has been shown to enhance pain relief and functional outcomes, although studies directly comparing these approaches are limited (69,70). Similarly, LLLT has been shown to significantly improve pain and function in UNE patients, with notable improvements in grip strength and in electrophysiological assessments, as well as symptom reduction, suggesting its potential for further exploration in clinical practice (40,69,80). HILT has recently been explored in UNE treatment, with promising results in pain relief and nerve conduction enhancement, suggesting its potential as an adjunctive therapy (85). Taping techniques, particularly kinesiotaping, have gained recognition in managing UNE (47). The effectiveness of local corticosteroid injections in UNE remains debated, as most existing research is extrapolated from CTS studies (89,97). While some studies have demonstrated symptomatic relief following corticosteroid injections, others report no significant benefit compared to placebo (90,91). PRP injections have emerged as an alternative, with findings suggesting greater long-term nerve healing potential compared to corticosteroids in mild UNE cases (92). Ultrasound-guided injections have also been recommended to improve accuracy and minimize complications reinforcing the importance of technique selection in optimizing treatment outcomes (93,94).

In summary, while conservative treatment is effective for many UNE patients, the level of evidence varies across interventions. Splinting, patient education, and nerve mobilization exercises appear to be the most beneficial, while physical therapy modalities and taping methods serve as adjunct therapies with limited long-term evidence. Future research should focus on comparative studies to determine the most effective multimodal treatment strategies for UNE management.

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Abbreviations list

UNE: Ulnar neuropathy at the elbow
CuTS: Cubital tunnel syndrome
CTS: Carpal tunnel syndrome
AP: Adductor pollicis
FPB: Flexor pollicis brevis
MCP: Metacarpophalangeal
EDx: Electrodiagnostic
MRN: Magnetic resonance neurography
DTI: Diffusion tensor imaging
NCS: Nerve conduction studies
CSA: Cross-sectional area
KT: Kinesiotaping
NCV: Nerve conduction velocities
SWD: Shortwave diathermy
LLLT: Low-level laser therapy
COX-2: Cyclooxygenase-2
Nd- YAG: Neodymium-doped yttrium aluminum garnet
VAS: Visual Analog Scale
ESWT: Extracorporeal shock wave therapy
QuickDASH: Quick Disabilities of the Arm, Shoulder, and Hand
RCTs: Randomized controlled studies
PRP: Platelet-rich plasma
NSAIDs: Nonsteroidal anti-inflammatory drugs
TCA: Tricyclic antidepressants
SNRIs: Serotonin-norepinephrine reuptake inhibitors

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