Case Report

Medical diagnosis of cubital tunnel syndrome ameliorated with thrust manipulation of the elbow and carpals

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This case report describes the effectiveness of thrust manipulation to the elbow and carpals in the management of a patient referred with a medical diagnosis of cubital tunnel syndrome (CuTS). The patient was a 45-year-old woman with a 6-week history of right medial elbow pain, ulnar wrist pain, and intermittent paresthesia in the ulnar nerve distribution. Upon initial assessment, she presented with a positive elbow flexion test and upper limb neurodynamic test with ulnar nerve bias. A biomechanical assessment of the elbow and carpals revealed a loss of lateral glide of the humerus on the ulna and a loss of palmar glide of the triquetral on the hamate. After the patient received two thrust manipulations of the elbow and one thrust manipulation of the carpals over the course of four sessions, her pain and paresthesia were resolved. This case demonstrates that the use of thrust manipulation to the elbow and carpals may be an effective approach in the management of insidious onset CuTS. This patient was successfully treated with thrust manipulation when joint dysfunction of the elbow and wrist were appropriately identified. This case report may shed light on the examination and management of insidious onset CuTS.

Keywords: Elbow pain, Ulnar nerve neuropathy, Biomechanical dysfunction, Humeroulnar joint manipulation, Neurodynamic

Background

Cubital tunnel syndrome (CuTS) is second only to carpal tunnel syndrome as the most frequently diagnosed peripheral neuropathy of the upper extremities.[1,2] Etiology includes repetitive or prolonged compression, traction, or ischemia of the ulnar nerve as it courses through the cubital tunnel via activities involving repetitive or prolonged elbow flexion, trauma, fibromuscular compression from the triceps, and compression from osteophytes, ganglia, lipomas, and cysts.[2] Excessive cubitus valgus deformity similar to the 'abducted ulnohumeral lesion' described by Fryette[3] has also been considered as a potential cause of CuTS.[4] Common conservative medical intervention focuses primarily on nerve gliding exercises, patient education, rest, non-steroid anti-inflammatory drugs (NSAIDs), activity modification, splint immobilization, bracing, and ergonomic changes, but manual therapy, specifically joint manipulation, has rarely been included in the plan of care for CuTS.[1,2,4]

Despite the prevalence of CuTS, there is limited literature supporting the use of thrust manipulation for extremity dysfunctions[5–9] and none for CuTS. One review of compressive ulnar neuropathy supported the use of non-thrust joint mobilizations of the ulna on the humerus to increase elbow range of motion, but thrust manipulation was not included in the review.[2] Two case reports have demonstrated the benefit of use of neurodynamic mobilization techniques (nerve gliding), and combination of pulsed ultrasound, ice, strengthening exercises, and patient education.[10,11]

In summary, little has been published regarding physical therapy (PT) management for CuTS, and no study has addressed the use of thrust manipulation for CuTS. Therefore, the purpose of this case report is to describe the outcome of thrust manipulation to the elbow and carpals on a patient with insidious onset of CuTS.

Patient Characteristics

A 45-year-old woman presented with a 6-week history of insidious onset right medial elbow pain, ulnar-sided wrist pain, and intermittent paresthesia in the ulnar nerve distribution. On initial examination, she rated her pain on a numerical pain rating scale (0 being no pain, 10 being worst pain) as varying between 2 and 6. Paresthesia was aggravated by holding the phone to her ear with her right arm, sleeping on her right side,

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and using a computer. Lifting her children, pushing, and pulling with her right arm or leaning on an outstretched arm with elbow extended while sitting on the floor would aggravate her medial elbow and ulnar wrist pain. She denied any neck, shoulder, or radicular pain. She saw her physician a week before attending PT. Radiographs of the right elbow and wrist were negative for evidence of fracture or dislocation. No further diagnostic testing was performed or planned. Prior medical history was negative for radicular pain, right shoulder, elbow or wrist injury or dysfunction. She also completed the disability of arm, shoulder, and hand (DASH) questionnaire on the initial visit and scored 10%.

Examination

The examination was carried out in a systematic order that first confirmed pathology of musculoskeletal origin because of insidious onset, followed by location of pathology and biomechanical dysfunctions.

Upper quadrant screen examination

The upper quadrant (UQ) screen examination consisted of observation, selective tissue tension test (STTT) of the cervical spine and upper extremities, cervical compression and distraction tests, and neurological testing of the upper extremities. The purpose of the UQ screen examination was to rule out potential serious pathology not appropriate for PT. During the inspection of her standing posture, an increased carrying angle was noted with the right elbow being 10° greater than the left elbow. No other deformity or atrophy was noted. As described by Cyriax and Cyriax,[12] the STTT consisted of active, passive, and isometric resisted movements. The results would reveal the severity and irritability of the patient's symptoms, and differentiate between contractile versus non-contractile tissue lesions. Active and resistive movement tests were non-provocative; however, passive overpressure for elbow flexion, wrist extension, and ulnar deviation reproduced her medial elbow and ulnar wrist pain (Table 1). Next, cervical compression (Spurling's)[13] and distraction tests were performed with both tests being negative. Although the cervical distraction and Suprling's tests have been shown to be specific but not sensitive for cervical radiculopathy, when these two tests and all cervical movement tests are negative, cervical pathology such as disc herniation or foraminal stenosis, is unlikely.[13] However, during the STTT of the right upper extremity, the patient exhibited joint restrictions of the right elbow flexion and supination, and right wrist extension and ulnar deviation. A standard procedure was carried out to obtain the active range of motion of the elbow and wrist using a universal goniometer (Table 1).[14]

Neurological testing included deep tendon reflexes of C5–C8, sensory testing of the dermatomes C5-T1, strength testing of key muscles in myotomes C5–C8, the Hoffmann's reflex, and the ankle jerk for clonus. All neurological tests with the exception of the Hoffmann's and the clonus tests have been shown to have high specificity but lack of sensitivity for cervical radioculopathy.[13] However, when all of the neurological tests were negative, the presence of upper and lower motor neuron lesions is unlikely. Upon completion of the UQ screen examination, it was apparent that the patient's symptoms were of musculoskeletal origin, and there was no indication of serious pathology. Also, we concluded that the cervical spine was ruled out as a source of the patient's symptoms.

Ligamentous stress tests

Stress tests of the radial and ulnar collateral ligaments of the elbow were performed with the patient lying in a supine position with the right arm slightly abducted from the patient's side.[15] Both the ligamentous stress tests were performed in full elbow extension and at 30°. All collateral stress tests were negative for laxity and pain free in this patient. A 'moving valgus stress test' has been described where a valgus force is applied and maintained to the elbow as the examiner quickly moves the elbow from full flexion to full extension.[15] Reproduction of medial elbow pain was considered positive and was found to be highly specific and sensitive compared to arthroscopic or surgical stress testing. The 'moving valgus stress test' was negative for laxity and reproduction of medial elbow pain in this patient.

Table 1 Selective tissue tension test results with range of motion of joint restriction measured by a universal goniometer on the initial examination

	Active range of motion	Passive overpressure	Resistive testing
Right elbow			
Flexion	Lacks 10°	Pain at medial elbow	Strong and pain free
Extension	Full	None	Strong and pain free
Supination	Lacks 10°	Pain at medial elbow	Strong and pain free
Pronation	Full	None	Strong and pain free
Right wrist			
Flexion	Full	None	Strong and pain free
Extension	Lacks 5°	Pain at ulnar wrist	Strong and pain free
Radial deviation	Full	None	Strong and pain free
Ulnar deviation	Lacks 5°	Pain at ulnar wrist	Strong and pain free

Special tests

Given the paresthesia along the ulnar distribution distal to the elbow, CuTS was likely. At that time, the elbow flexion test was selected to rule in CuTS because this test has been found to have a high specificity (0.99), but a moderate sensitivity (0.75).[16] The elbow flexion test was performed by placing the elbow in the flexed position for 60 seconds.[16,17] With prolonged flexion of the elbow, there is decreased volume and increased pressure within the cubital tunnel, leading to local ischemia of the ulnar nerve and increasing irritability with the potential for pain, numbness or tingling in the distribution of the nerve.[17] During the elbow flexion test, the patient reported reproduction of paresthesia in an ulnar distribution on the right side within 25 seconds. The positive finding increased the likelihood of CuTS.

This was followed by the upper limb tension test (ULTT) with ulnar nerve bias, which is a neurodynamic test aimed to place stress through the neurologic structures of the upper extremity.[13,18,19] This test was performed as described by Butler[19] and Byl *et al.*[18] to rule out other pathologies that may cause paresthesia in the ulnar nerve distribution, such as cervical radiculopathy,[13] thoracic outlet syndrome, and brachial plexopathy. During the ULTT, paresthesia in the distribution of the ulnar nerve was reproduced when wrist and finger extension were added. Recent literature has shown increased strain to the ulnar nerve during positioning of the upper extremity as described.[18]

Passive movement tests

Modified combined motion testing adopted from Maitland[9] was performed to further examine the quality of joint motion at the elbow. This combined motion testing consists of four separate movement tests including flexion/adduction/pronation, flexion/abduction/ supination, extension /adduction/supination, and extension/abduction/pronation. These tests are aimed at detecting subtle changes in elbow passive range of motion that cannot be fully assessed when examining only the planar joint motions. When the end range of the combined motions was reached, a scouring motion (i.e. an arc of motion) was applied to the elbow through the forearm with a gentle overpressure. The patient had restriction with flexion/adduction/supination, with a hard end-feel and medial elbow pain.

Passive accessory movement (PAM) testing was used to assess the ability of joint surfaces to glide upon each other. PAM testing can identify structural dysfunction, thereby affecting the treatment plan. Testing was performed each at the elbow (humeroulnar, radiohumeral, and proximal radioulnar joints), wrist, and carpals.[9,20] During PAM testing, the patient was lying supine, and each joint assessed was placed in its loose pack position. A recent study investigating the reliability of accessory testing of the carpal joints found acceptable intrarater and interrater reliability for carpal joint mobility and very good reliability of end-feel judgments.[21] The only significant findings were a decreased lateral glide of the humeroulnar joint and a decreased palmar glide of the triquetral on the hamate. The examiner sensed a blocked (not bony) pathomechanical[9] end-feel for both restrictions, rather than a normal capsular end-feel or a hard-capsular end-feel, as often sensed in patients after prolonged immobilization. Thrust technique has been recommended when there is a blocked pathomechanical end-feel during PAM.[9]

Clinical Impression

Based on the results of subjective and objective examinations, the provisional clinical assessment was a primary biomechanical lesion of the humeroulnar joint and carpals, with a secondary neurodynamic lesion of the ulnar nerve, possibly a result of the increased carrying angle of the elbow often seen with an abducted ulna lesion.[3] The most significant findings supporting the medical diagnosis of CuTS were from the elbow flexion test and the ULTT test, implicating the ulnar nerve as a likely source of the patient's symptoms.

The abnormal PAM findings at the humeroulnar joint and the lateral column of carpals were likely the underlying structural dysfunctions contributing to the ulnar neuropathy (CuTS). Fryette[3] purported that either a fall onto an outstretched arm or repetitive pushing through an extended elbow would shift the olecranon medially, creating an abducted ulna which would cause the joint to be separated on medially and approximated laterally.[3] Given the absence of a trauma for an abducted ulna lesion, it was hypothesized that a possible source of the patient's symptoms was a recent increase in the amount of time that she spent supporting herself with an outstretched right arm while in side-sitting, playing on the floor with her children. Subsequently a new, repetitive, and microtraumatic activity such as prolonged support on an outstretched arm with full wrist extension could account for the presence of the abducted ulna and carpal dysfunction.

It has been suggested that muscle length changes as a function of the elbow and wrist angles.[22] Eccentric contraction through a muscle with altered tension has been shown to lead to myofibrillar damage and pain.[23] We speculated that this may apply to either flexor carpi ulnaris or radialis. However, with negative contractile testing, it was unlikely in this case. In a literature review of tennis elbow, Lee concluded that an abducted ulna would change the tension in the superior and inferior radioulnar ligaments, interosseous membrane, and all of the associated muscular

Figure 1 Lateral thrust manipulation of the humeroulnar joint.

attachments.[24] An abducted ulna lesion has been associated with cubital tunnel syndrome because the ulnar nerve would receive increased tension due to its longer course through the cubital tunnel and into the forearm.[3,4,23] Potential consequences, with as little as 8% elongation of the nerve include neural ischemia, excessive compression with repetitive or prolonged elbow flexion, decreased diameter of the nerve, and impaired conduction of neural impulses.[23,25] Subsequently, a peripheral nerve lesion could potentially occur as presented in this patient.

Intervention

Treatment one: initial session

Immediately after the examination was completed, a thrust manipulation was performed to the humeroulnar joint to address the biomechanical dysfunction and restore the lateral glide (Fig. 1).[3,9] Thrust manipulation was chosen, based on the blocked pathomechanical end-feel.[9] The PT grasped the distal medial humerus proximal to the humeroulnar joint with one hand, and supported the proximal radius, immediately distal to the humeroulnar joint with the other hand while the patient was in a supine lying position. The humeroulnar joint was then passively taken to the barrier, at which point a pre-manipulative hold was performed to ensure the patient's comfort and to avoid aggravation of symptoms. The motion barrier was re-attained, and a thrust manipulation was produced with the hand on the distal humerus in a medial to lateral direction. Following the manipulation, the patient reported a decrease in medial elbow pain and was able to demonstrate full elbow flexion and supination without provocation of pain. The restricted combined motion was pain-free and no longer limited. Lateral glide of the humeroulnar joint was also restored.

Figure 2 Start (left) and finish (right) palmar thrust manipulation of triquetral on hamate.

However, the palmar glide of the triquetral on the hamate was still restricted. Therefore, a carpal manipulation thrusting the triquetral palmarly on the hamate was performed (Fig. 2).[7,26] The PT grasped the patient's wrist with the patient's palm down, stabilizing the hamate palmarly with both index fingers, one over top of the other and placing the thumbs over the patient's triquetral on the dorsum of the wrist while the patient was in a seated position. The thumbs exerted a downward pressure in a palmar direction for the pre-manipulative hold to determine the patient's tolerance to the manipulation. The patient tolerated the pre-manipulative hold; therefore, the manipulative thrust was applied. The patient was asked to gently lean back, producing a small amount of traction through the carpals. Keeping the patient's wrist in slight flexion, the PT applied a downward thrust in a palmar direction to the triquetral. Reassessment revealed normalized mobility of the carpals with pain-free wrist extension and ulnar deviation. The patient was instructed on pain-free active range of motion of the elbow and wrist, focusing primarily on elbow flexion and supination, and wrist extension and ulnar deviation to ensure that active motion was occurring in the newly gained ROM. The patient was advised to avoid supporting herself for prolonged periods of time on an outstretched right arm when playing with her children on the floor.

Follow-up visits

Upon the patient's return to the clinic 2 days later, reassessment revealed a negative ULTT with ulnar nerve bias and normal carpal mobility. The elbow flexion test was less provocative, with paresthesia produced after 60 seconds compared to 25 seconds on her first visit. The humeroulnar joint mobility was normal for visits 2 and 3 but was again restricted on visit 4. The patient admitted to bearing weight through an extended right elbow while playing on the floor with her children. The humeroulnar joint was manipulated a second time as described previously. The patient returned for one final visit, approximately 4 weeks after her first session, for her discharge assessment. She reported having no elbow or wrist pain and all previous positive tests were negative.

Outcomes

Table 2 lists the patient's improvement throughout the course of PT. The patient's DASH questionnaire score was 10% on the initial visit and 0% upon discharge.

Discussion

This case report demonstrated that a patient with insidious onset of CuTS was successfully treated using thrust manipulation to the elbow and carpals. There is evidence for the use of thrust manipulation or mobilization to the elbow and carpals in the treatment of lateral epicondylalgia.[5–9] We speculated that the pathomechanics would be very similar for the CuTS as a result of an abducted ulna lesion. CuTS is often viewed as a primary neuropathy, but in cases of insidious onset, assessment of potential underlying biomechanical dysfunction along the course of the ulnar nerve, including the elbow and carpal articulations, may provide a course of treatment that can have a potential positive outcome on patient symptoms and function. It is important to recognize that biomechanical lesions of joints along the course of nerves, such as an abducted ulna lesion, may contribute to a neuropathy. In this patient, we recognized that both an abducted ulna lesion and a carpal lesion were present. These lesions were potentially placing tension or elongation through the ulnar nerve as it courses through the cubital tunnel at the posterior medial elbow and as the terminal branches of the ulnar nerve course between the hook of hamate and pisiform in Guyon's Tunnel. These two sites of dysfunction would cause excessive neural compression with repetitive or prolonged elbow flexion and wrist extension, decreasing the diameter of the ulnar nerve, causing neural ischemia and impairing conduction of neural impulses. Although neurodynamic mobilization techniques have been shown to be beneficial for CuTS, we felt that the neurodynamic treatment may not be sufficient or produce immediate resolution of symptoms in this

Table 2 Summary of the patient's objective findings throughout the course of physical therapy

	Visit 1	Visit 2	Visit 3	Visit 4	Discharge
	Initial visit	2 days after visit 1	1 week after visit 1	2 weeks after visit 1	4 weeks after visit 1
Elbow flexion test	(+) Paresthesia in 25 seconds	(+) Paresthesia in 60 seconds	(−)	(+) Paresthesia in 60 seconds	(−)
Upper limb neurodynamic test	(+) Paresthesia	(−)	(−)	(−)	(−)
Humeroulnar joint mobility	Reduced	WNL	WNL	Reduced	WNL
Carpal mobility	Reduced	WNL	WNL	WNL	WNL
Numerical pain rating scale	2–6/10	4/10	1/10	3/10	0/10

patient due to the insidious onset of symptoms and the underlying biomechanical dysfunction.

In terms of prognosis, this patient did not have a prior history of cervical or right upper extremity injury and did not have dysfunction prior to this episode. There was no evidence of neurologic deficit, muscular lesion, or ligamentous laxity. Given this patient's insidious onset of symptoms over a short period of time, low severity and irritability of symptoms, and rapid resolution of both medial elbow and ulnar wrist pain, and ulnar nerve paresthesia to thrust manipulation of the elbow and carpals, we felt that the patient had an excellent prognosis to remain symptom free. However, it seems plausible, given the young age of her children, that if she continues to support herself in side-sitting on an fully extended elbow and wrist while playing with her children for prolonged period of time, it is likely that she will have a relapse of her symptoms.

Conclusion

This case report showed positive and rapid resolution of elbow symptoms using thrust manipulation of the humeroulnar joint to treat an abducted ulna lesion. This case report indicates that thrust manipulation of the elbow and carpals can have a positive impact on patient's symptoms and functional abilities with a diagnosis of CuTS. Due to limited reliability and validity of the examination and treatment methods and the nature of a case report, one must be cautious not to infer a causal relationship between thrust manipulation and resolution of symptoms. Further research into thrust manipulation of the extremities and other conservative management of CuTS are necessary.

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