



Repetitive overuse induced carpal tunnel syndrome: An evidence based review

Vivek H Ramanandi

Assistant Professor, SPB Physiotherapy College, Surat, Gujarat, India

Abstract

An overuse injury can lead to repetitive stresses on the structures underlying carpal ligament including median nerve and is known as carpal tunnel syndrome (CTS). Management of CTS included medical, physiotherapeutic and orthotic interventions. This mini review aims to provide summary of CTS with specific focus on the physical and functional diagnosis along with physiotherapeutic and other interventions aimed at short- and long-term management of CTS.

Keywords: carpal tunnel syndrome, ICF, physiotherapy, rehabilitation, repetitive overuse

Introduction

Background

Carpal tunnel syndrome (CTS) results from the compression of the median nerve at the wrist caused by many different factors. The prevalence of median nerve symptoms and electrophysiological median neuropathy is 4.9%.^[1] The overall lifetime prevalence of self-reported and physician-diagnosed CTS, regardless of work status, is 8.0%.^[2] For women, the prevalence is nearly twice that for men (10% compared to 5.8%).^[2] There is a marked increase in prevalence with increasing age: 3.7% in those younger than 30 years of age compared to 11.9% in those over 50 years of age.^[2] The patients usually report intermittent bilateral tingling and numbness, particularly over the thumb and first two fingers of both hands. It is especially worse in the morning and patients notice occasional clumsiness with gripping and carrying things.

Physical & Functional Impact of CTS on the Patient & Family

Effect on Person's Body structure & Function:

- Sensory symptoms like tingling and numbness around thumb and first two fingers.^[3]
- Patient may show heightened anxiety because of CTS and its associated impairments.^[4]

Activity Limitation

- Difficulty in gripping and carrying things with affected hand.^[3]
- Difficulty in occupation related work such as if the patient is an electrician, he will face issues while handling small tools and equipment with his hands.^[3]
- Difficulty in his performance while playing competitive sports or such leisure activities.^[3]

Participation Restriction

- Limited involvement in his professional job works due to difficulty in handling work related activities.^[5]
- Limited participation in his leisure and professional activities.^[3]

Impact on family & relatives

- As the patient is unable to perform his occupational activities finely, his income may be affected which in turn will increase financial and psychological burden on other earning members of the family.^[3]
- As the patient has limited participation in his leisure time as well competitive sports activity, his social interaction and communication will be lesser as compared to past which may in turn affects his social involvement.^[5]
- Restrictions in basic and advanced activities of daily living (ADLs) will also affect patient's psychological status and increase levels of stress and anxiety leading to altered interaction patterns with his friends or colleagues at his workplace.^[5]

Review of Current Treatment Protocols

The patient showed typical median nerve associated symptoms due to CTS. Medical management shall comprise of Diuretics, non-steroidal anti-inflammatory drugs (NSAIDs), pyridoxine (vitamin B6), and orally administered corticosteroids.^[6]

Rehabilitative interventions shall include use of orthoses, biophysical agents (e.g. superficial or deep heat, interferential current, non-thermal ultrasound, phonophoresis, etc.) and assistive technology (e.g., arrow keys,

touch screens, etc).^[2] Physical therapy treatments have shown to have conflicting evidences (level 3) concerning the use and efficacy of exercise therapy, laser and ultrasound in treatment of carpal tunnel syndrome.^[7] Splints have shown to be effective when used for full time, with moderately strong literary support.^[7]

Personalised Management Plan

- Short Term Plan
- Goals:
 - a. Relief of acute pain
 - b. Relief of intermittent neurological symptoms
 - c. Increasing functional strength
 - d. Prevention of disease progression
 - e. Protection of anatomic structures in carpal tunnel
 - f. Education for prevention and protection of structures

Interventions

1. Orthosis Prescription

- a. Clinicians should recommend a neutral-positioned wrist orthosis worn at night for short-term symptom relief and functional improvement.^[8]
- b. Stretches: for wrist extension & flexion 5 repetitions, 4 times a day for 5 to 7 days a week

2. Biophysical Agents

- a. Microwave diathermy for short-term pain and symptom relief given for 20-minute sessions, twice weekly for 3 weeks.^[7]

3. Manual Therapy

- a. Manual therapy, directed at the cervical spine and upper extremity soft tissue and joint mobilization for 3 weeks.^[9]
- b. Education including activity modifications for performing work related and home tasks including tennis practice.^[9]

- **Medium Term Plan**

- **Goals**

- a. Facilitation of healing
- b. Relief of intermittent neurological symptoms
- c. Increasing grip strength
- d. Prevention of disease progression
- e. Protection of anatomic structures in carpal tunnel
- f. Promoting neural mobility
- g. Training for self-treatment

- **Interventions**

1. Sound Agents

- a. Use of non-thermal continuous ultrasound 0.5 W/cm^[2], 10 min/session, 5 days/week for 4 to 6 weeks)^[10]

2. Manual Therapy

- a. Nerve mobilization for median nerve 10-15 repetitions per day for 6-7 days a week^[11]
- b. Carpal bone mobilization^[9]
- c. Nerve & tendon self-gliding exercises for 5-10 repetitions, 2-3 times a day, holding each position for 3 seconds and progress as tolerated, continued for 4-8 weeks.^[12]

3. Strengthening of Gripping Muscles

- a. Using an exercise ball actively for 30 s to 1 min two times/day for a 3-month period.^[13]

- **Long Term Plan**

- **Goals:**

- a. Increasing grip strength and carpal mobility
- b. Prevention of disease progression
- c. Protection of anatomic structures in carpal tunnel
- d. Promoting awareness and educating for prevention and protection

- **Interventions**

1. Patient education on pathology, risk identification, symptom self-management, and postures/ activities that aggravate symptoms
2. Educate their patients regarding the effects of pliers or other tools used for electric work on carpal tunnel pressure and assist patients in developing alternate strategies. Also training and education on practicing correct posture and gripping as well as playing technique while playing tennis. Change in the weight and size of tennis racquet if necessary.
3. Nerve & tendon self-gliding exercises for 4 weeks along with self-mobilization^[12]

4. Yoga postures practice including 11 yoga postures designed for strengthening, stretching, and balancing each joint in the upper body along with relaxation given twice weekly for 8 weeks. ^[14]

Clinical Outcome Measures

Clinical, neurophysiologic and patient-oriented evaluation including outcome measures such as- ^[2]

1. Provocative Tests
2. Sensory Measures
3. Pain Report Measures
4. Activity Limitations/Self-reported Measures
5. Physical Performance Measures
6. Electrophysiological test

The documentation should include- ^[2]

- Examination
- Patient age
- Katz hand diagram (location of symptoms) ^[15]
- Wrist ratio index ^[16]
- Whether shaking hands provides relief
- Duration of symptoms
- Intensity of symptoms
- Frequency of symptoms
- Prior nonsurgical interventions
- Presence of thenar atrophy (indication of severe CTS)
- Activity Limitations – Self-report Measures
- CTQ-SSS (The Boston Carpal Tunnel Questionnaire-symptom severity scale) ^[17]
- CTQ-FS (Boston Carpal Tunnel Questionnaire-Functional Scale) ^[17]
- DASH (The Disabilities of the Arm, Shoulder and Hand) ^[2]
- Activity Limitations – Physical Performance Measures ^[2]
- PPB (the Purdue Pegboard)
- The DMPUT (the Dellon-modified Moberg pick-up test)
- Physical Impairment Measures
- SWMT (Semmes-Weinstein monofilament testing) - compare to normal value of 2.83 or 3.22 ^[17]
- Static 2PD (2-point discrimination) on the middle finger - compare to normal value of 6 mm ^[17]
- Phalen test, Tinel sign, and carpal compression test ^[2]
- Grip strength and tip or 3-point pinch strength to assess strength ^[2]

Role of other Health Professionals

a. Orthotist

Orthotist will be helpful in customizing the hand splint which will help in providing support and preventing damage to carpal tunnel structures. Initially night splint can be prescribed and later on dynamic hand splint can also help to strengthen muscles of wrist and hand or to facilitate function especially during use of tools.

b. Occupational therapist

Occupational therapist can work in providing occupation specific training for use of hand tools like pliers while avoiding unnecessary stress and unwanted position of wrist and hand. Occupational therapist can also help in identifying faults and modifying design of tools of daily occupational use. Also, with guidance of occupational therapist patient's tennis racquet design and size or weight can be modified to better suit the technique taught by physical therapist.

c. Physician

In case where there is little to no benefit from conservative physical interventions, the patient needs to be re-referred to physician for interventions including Diuretics and NSAIDs, Oral corticosteroids, local corticosteroid injection or carpal tunnel release surgery if it is required. It has been reported that locally injected steroids provide significant improvements even if this is temporary. Literature supports use of oral NSAIDs and diuretics with moderate strength and whereas use of oral steroids is strongly suggested to improve symptoms. ^[7]

References

1. Atroshi I, Gummesson C, Johnsson R, Ornstein E, Ranstam J, Rosen I. Prevalence of carpal tunnel syndrome in a general population. *JAMA*,1999;282:153-58.
2. Erickson M, Lawrence M, Jansen CWS, Coker D, Amadio P, Cleary C et al. Hand pain and sensory deficits: Carpal tunnel syndrome: Clinical practice guidelines linked to the international classification of functioning, disability and health from the academy of hand and upper extremity physical therapy and the academy of orthopaedic physical therapy of the American physical therapy association. *Journal of Orthopaedic & Sports Physical Therapy*,2019;49(5):CPG1-CPG85.

3. Jerosch-Herold C, de Carvalho Leite JC, Song F. A systematic review of outcomes assessed in randomized controlled trials of surgical interventions for carpal tunnel syndrome using the International Classification of Functioning, Disability and Health (ICF) as a reference tool. *BMC musculoskeletal disorders*,2006;7(1):1-10.
4. Beleckas CM, Wright M, Prather H, Chamberlain A, Guattery J, Calfee RP. Relative prevalence of anxiety and depression in patients with upper extremity conditions. *The Journal of hand surgery*,2018;43(6):571-e1.
5. Rostkowski SM. Identifying the Negative Social Environment as a Result of Having Carpal Tunnel Syndrome in the Workplace, 2017.
6. Hernández-Secorún M, Montaña-Cortés R, Hidalgo-García C, Rodríguez-Sanz J, Corral-de-Toro J, Montiballano S et al. Effectiveness of conservative treatment according to severity and systemic disease in carpal tunnel syndrome: A systematic review. *International Journal of Environmental Research and Public Health*,2021;18(5):2365.
7. Frasca G, Maggi L, Padua L, Ferrara PE, Granata G, Minciotti I. Short-term effects of local microwave hyperthermia on pain and function in patients with mild to moderate carpal tunnel syndrome: a double blind randomized sham-controlled trial. *Clinical rehabilitation*,2011;25(12):1109-1118.
8. Mishra S, Prabhakar S, Lal V, Modi M, Das CP, Khurana D. Efficacy of splinting and oral steroids in the treatment of carpal tunnel syndrome: a prospective randomized clinical and electrophysiological study. *Neurology India*,2006;54(3):286.
9. Bongi SM, Signorini M, Bassetti M, Del Rosso A, Orlandi M, De Scisciolo G. A manual therapy intervention improves symptoms in patients with carpal tunnel syndrome: a pilot study. *Rheumatology international*,2013;33(5):1233-1241.
10. Piravej K, Boonhong J. Effect of ultrasound thermotherapy in mild to moderate carpal tunnel syndrome. *Journal of the Medical Association of Thailand= Chotmaihet Thangphaet*,2004;87:S100-6.
11. McKeon JMM, Yancosek KE. Neural gliding techniques for the treatment of carpal tunnel syndrome: a systematic review. *Journal of sport rehabilitation*, 2008, 17(3).
12. Akalin E, El Ö, Peker Ö, Senocak Ö, Tamci S, Gülbahar S, ... Öncel S. Treatment of carpal tunnel syndrome with nerve and tendon gliding exercises. *American journal of physical medicine & rehabilitation*,2002;81(2):108-113.
13. Ünver S, Akyolcu N. The Effect of Hand Exercise on Reducing the Symptoms in Hemodialysis Patients with Carpal Tunnel Syndrome. *Asian journal of neurosurgery*,2018;13(1):31-36. https://doi.org/10.4103/ajns.AJNS_343_16
14. Garfinkel MS, Singhal A, Katz WA, Allan DA, Reshetar R, Schumacher Jr HR. Yoga-based intervention for carpal tunnel syndrome: a randomized trial. *Jama*,1998;280(18):1601-1603.
15. Calfee RP, Dale AM, Ryan D, Descatha A, Franzblau A, Evanoff B. Performance of simplified scoring systems for hand diagrams in carpal tunnel syndrome screening. *The Journal of hand surgery*,2012;37(1):10-17.
16. Moghtaderi A, Izadi S, Sharafadinzadeh N. An evaluation of gender, body mass index, wrist circumference and wrist ratio as independent risk factors for carpal tunnel syndrome. *Acta neurologica scandinavica*,2005;112(6):375-379.
17. Marlowe ES, Bonner Jr FJ, Berkowitz AR. Correlation between two-point discrimination and median nerve sensory response. *Muscle & nerve*,1999;22(9):1196-1200.