**Huisstede BM, Hoogvliet P, Randsdorp MS, and et al. Carpal Tunnel Syndrome. Part I: Effectiveness of Nonsurgical Treatments–A Systematic Review. *Arch Phys Med Rehabil* 2010; 91:981-1004.**

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**Design:** Systematic review and meta-analysis of systematic reviews and randomized clinical trials (RCTs)

**Date:** 12-3-15 LM

**Study Question:** To review the literature systematically and determine the effectiveness of all types of nonsurgical interventions for treating carpal tunnel syndrome (CTS).

**PICOs:**

* **Patients:** Patients with CTS not caused by an acute trauma or any systemic disease.
* **Interventions:** Splinting, ultrasound, ergonomic keyboards, oral medication, steroid injections, vitamins, exercise, yoga, mobilization, magnet therapy, chiropractic care, laser, acupuncture, manual therapy, magnetic field stimulation, massage therapy, heat wrap therapy, cupping therapy, botulinum B toxin, and iontophoresis.
* **Comparison interventions:** The control group could be a no treatment placebo group, another treatment usually a standard treatment, or both.
* **Outcomes:** Various assessments of pain, function, or recovery.
* **Study types:** Randomized controlled trials (RCTs) and systematic reviews.

**Study selection:**

* Databases included the Cochrane Library, the Cumulative Index of Nursing Allied Health Literature (CINAHL), PubMed, EMBASE, and the Physiotherapy Evidence Database (PEDro) through January 2010. There were no language restrictions.
* Two reviewers independently applied the inclusion criteria to select potential relevant studies from the title and abstracts of the references retrieved by the literature search.
* Two researchers independently extracted the data, and assessed the methodologic quality of each RCT based on the 12 quality criteria. High quality was defined as a “yes” score on 50% or more of the criteria on the methodologic quality assessment. If a RCT scored less than 50%, they were defined as low quality studies. Evidence from low quality RCTs was not considered in this critique.
* The strength of the evidence was ranked and divided into the following levels:

1. Strong evidence for effectiveness: consistent (75% of the trials report consistent findings); significant findings within multiple higher-quality RCTs

2. Moderate evidence for effectiveness: Consistent significant findings within multiple lower-quality RCTs and/or 1 high-quality RCT.

3. Limited evidence for effectiveness: significant findings within 1 low-quality RCT

4. No evidence found for effectiveness of the inventions: RCTs available, but no significant differences between the intervention and control groups were reported.

5. No systematic review or RCT found, insufficient evidence.

* For the purposes of this critique, limited evidence from low quality RCTs was considered an absence of evidence.
* A best-evidence synthesis was performed to summarize the results of the included studies.

**Results:**

* A total of 55 RCTs are included in this systematic review. Of these, 28 RCTs (55%) were considered of high methodologic quality. A total of 22 were independent RCTs and 33 RCTs were included in 2 Cochrane reviews.
* A meta-analysis or statistical pooling of the results of the individual trials was not done because of the perceived heterogeneity of the studies.
* Splinting
  + There is moderate evidence in the short term (< 3 months) and absence of evidence in the midterm (4-6 months) that a nocturnal hand brace is more effective for reducing pain and improving function than no therapy in the treatment of patients with CTS.
  + There is moderate evidence in the short term that a 3-month night treatment with either the soft hand brace or the wrist splint is effective in reducing symptoms and improving function in patients with CTS, but there is no significant difference between the 2 interventions.
  + There is moderate evidence that 6 weeks of oral steroids are more effective in improving function, but not symptoms, than splinting of the wrist for 4 weeks to treat CTS in the short term.
  + There is no evidence that the addition of low-level laser therapy to full-time hand splinting in the neutral position for 3 months is more effective than splinting alone.
  + There is an absence of evidence for the effectiveness of a full-time use of a wrist splint compared with night-only use in patients with CTS in the short term.
  + There is an absence of evidence that the use of a wrist splint in neutral position is more effective than an extended wrist position of 20° in patients with CTS in the short term (2 weeks).
  + There is an absence of evidence that the addition of tendon and nerve gliding exercises to 4 weeks of night splinting is more effective than splinting alone.
  + There is an absence of evidence for the effectiveness of yoga compared with wrist splinting to treat CTS in the short term.
* Ultrasound/Laser
* There is strong evidence that laser therapy is ineffectiveness compared with placebo as an intervention to treat CTS in the short term.
* There is moderate evidence that there is no significant difference between an ultrasound intensity of 1.5W/cm2 compared with 0.8W/cm2 in the short term treatment of patients with CTS.
* There is moderate evidence that ultrasound is more effective on pain and function than laser therapy in the treatment of patients with CTS in the short term.
* There is no evidence for the effectiveness of ultrasound compared to placebo at 2 weeks of follow-up, but there is moderate evidence that ultrasound is more effective in improving symptoms only, not function, than placebo in the treatment of patients with CTS at 7 weeks of follow-up and in the midterm.
* There is an absence of evidence for the effectiveness of 1 or 3 MHz frequency of ultrasound in patients with CTS in the short term with no significant differences found between frequencies.
* Oral Medications and Vitamins
* There is strong evidence that oral steroids are more effective than placebo in the short term, and moderate evidence that they are not effective in the long term.
* There is no evidence for the effectiveness of anti-inflammatory drugs, diuretics, or Vitamin B6 in the short term.
* Mobilization and Manual Therapy
* There is moderate evidence that soft tissue mobilization plus home exercises is effective to treat CTS in the midterm.
* No evidence was found for the effectiveness of a neuro-dynamic technique plus splinting in the short term.
* There is an absence of evidence for the effectiveness of carpal bone mobilization in the short term.
* There is an absence of evidence for the effectiveness of chiropractic therapy (manual thrusts, myofascial massage, ultrasound, and nocturnal wrist splint) compared with ibuprofen and wrist splint for CTS in the midterm.
* Ergonomic Keyboards
* There is an absence of evidence that an ergonomic keyboard is more effective than a standard keyboard in the short term.

* Other Modalities
  + There is no evidence for the effectiveness of laser acupuncture or dexamethasone iontophoresis for the treatment of CTS in the short term.
  + There is an absence of evidence for the effectiveness of massage therapy, heat wrap therapy, and cupping therapy for the treatment of CTS in the short term.
* Corticosteroid Injections
  + There is strong evidence that a corticosteroid injection is more effective than placebo in the treatment of patients with CTS in the short term.
  + There is moderate evidence that local corticosteroid injections are more effective than systemic corticosteroid injections to treat CTS in the short term.
  + There is moderate evidence that corticosteroid injections are more effective than oral steroids in the short term, but no evidence in the long term (> 6 months).
  + There is moderate evidence that 60mg methylprednisone injection is more effective than 20 or 40mg methylprednisone in the midterm, but no evidence to treat CTS in the long term.
  + There is no evidence of a significant difference between a corticosteroid injection compared with anti-inflammatory medication plus splinting regarding pain and symptom improvement at 2 and 8 weeks after treatment.
  + There is no evidence of a difference of a single compared with 2 local corticosteroid injections with15mg methylprednisolone in the treatment of patients with CTS in the short term, midterm, and long term.
  + There is an absence of evidence for the effectiveness of short-acting compared with long-acting corticosteroid injection in the treatment of patients with CTS in the short term.
  + There is an absence of evidence that a corticosteroid injection is more effective than iontophoresis or phonophoresis.

**Authors’ conclusions:**

* In comparison with the conclusions of the Cochrane reviews of O’Connor (2003) and Marshall (2007), this review found similar results for most interventions.
* This review found effectiveness for electromagnetic field therapy, ergonomic keyboards, cupping therapy compared with heat pads in the short term, and ultrasound in the midterm. The findings of this review showed midterm, but no long-term benefit of steroid injections.
* Strong and moderate evidence for effectiveness was found for corticosteroids (oral or injected), and a corticosteroid injection seems to be the most effective. In the midterm, moderate evidence was found for a higher dose of injected methylprednisone (60mg) compared with a lower dose (20 or 40mg). The effectiveness of the steroids was not maintained in the long term.
* Moderate evidence was found for the effectiveness of ultrasound in the short term and midterm.
* Moderate evidence was found for the effectiveness of the use of a nocturnal hand brace compared with no treatment in the short term. Further, we found that night splinting is as effective as whole-day splinting. This may suggest that a patient can wear a splint only at night to achieve a similar improvement in outcome. No long-term results for the effectiveness of splinting were found.
* Moderate evidence was found for the effectiveness of an ergonomic keyboard compared with a standard keyboard in the short term.

**Comments:**

* This systematic review used a best evidence synthesis to summarize the results of the included studies, but lacked the precision that a meta-analysis would provide.
* This systematic review encompasses a thorough review of the older literature on nonsurgical treatments for CTS, but does not include any recent RCTs published within the last 5 years. All of the included recent RCTs were at least 5 years old and the included RCTs from the two Cochrane reviews published in 2003 and 2007 were even older.
* Only 28 or 55% of the included RCTs in this review were rated as high quality, and some of these probably should have been properly downgraded as low quality RCTs with a high risk of bias. At least 4 studies (Rempel, Irvine, Burke, Amirjani) that were assessed as high quality and met at least 50% of the quality criteria were very small studies ranging in size from 15 to 22 total participants. The authors noted that another 3 studies included in the Cochrane reviews that were rated as high quality according to the Cochrane quality criteria used, did not meet the definition of high quality used in this review (50% of the criteria were not met). Because of the high credibility and validity of Cochrane reviews, the authors decided to apply the methodologic quality criteria and definitions of high-quality and low quality studies used in a Cochrane review instead of the criteria used in this review for the Cochrane RCTs. These 7 high quality studies could possibly contribute to bias in outcome of evidence and conclusions.
* The authors failed to consider sample size when assessing the quality of the included studies. One study by Amirjani (2009) was assessed as high quality meeting at least 50% of the quality criteria, but was very small (sample size = 17), and should have been properly downgraded to a low quality RCT with a high risk of bias. This study is so small that it does not meet our quality standards or qualify for an evidence statement.
* The authors mistakenly assessed the quality of the Garfinkel (1998) study on yoga and wrist splinting as low quality. Using the Cochrane quality criteria, the study was downgraded for lack of blinding and performance bias. Lack of blinding and performance bias should not be a strike against this study’s quality, since blinding is not possible in this type of study. “Performance bias” is also inherently built into the study, in the sense that the yoga group intervention differed in many ways from the splint intervention, but the comparison of interventions remains reasonable, since yoga is by nature a more complex intervention that gives more attention to participants than wrist splinting. Our assessment of yoga and wrist splinting from this study does support an evidence statement.
* Because many of the treatments included in the review were active interventions, participants were aware of their allocation status, and so many of the RCTs were unable to blind participants to treatment allocation. This makes the results vulnerable to performance and detection bias. Given that the main outcomes of this review were participant self-reported pain and physical function, there is also a possibility that the treatment results may be inflated. Although there may be a potential study limitation for the evidence for pain and function (a potential for bias that may overestimate the effect sizes), it was not considered substantial enough to downgrade the evidence.
* Many of the RCTs included in this review made comparisons of two interventions of unknown effectiveness instead of comparing the intervention to placebo. It is difficult to assess the effectiveness of either intervention without a proper control group.
* With the exception of oral and steroid injections, no long-term results were reported for any of these treatments. Future research should assess the long-term effectiveness of these various treatments, especially steroid injections, for people with carpal tunnel syndrome in terms of disease progression and time to CTS release surgery.

**Assessment:**

* Adequate quality systematic review which supports a variety of evidence on the following nonsurgical interventions for treating patients with carpal tunnel syndrome;

Splints/Hand Braces

* + Some evidence in the short term (4 weeks) and absence of evidence in the midterm (4-6 months) that a nocturnal hand brace is more effective for reducing pain and improving function compared to no treatment.
  + Some evidence in the short term that a 3-month night treatment with either the soft hand brace or the wrist splint is effective in reducing symptoms and improving function, but there is no significant difference between the 2 interventions.
  + Some evidence that 6 weeks of oral steroids are more effective in improving function, but not symptoms, than splinting of the wrist for 4 weeks in the short term.
  + Some evidence that low-level laser therapy adds no benefit for reducing symptoms and improving function to full-time splinting for 3 months in the short term.

Ultrasound/Laser

* There is some evidence that ultrasound is no more effective than placebo at 2 weeks of follow-up regarding pain, symptoms and function, but there is some evidence that ultrasound is more effective in improving symptoms only, not function, than placebo at 7 weeks of follow-up and in the midterm (4-6 months).
* Some evidence that there is no significant difference between an ultrasound intensity of 1.5W/cm2 compared with 0.8W/cm2 regarding pain and symptom improvement after 2 weeks.
* Some evidence that ultrasound is more effective on pain and function than low level laser therapy at 4 weeks.
* Good evidence that laser therapy is ineffective regarding pain and function compared with placebo as an intervention to treat CTS in the short term.

Oral Medications and Vitamins

* There is good evidence that oral steroids are more effective than placebo in favor of symptom improvement in the short term, and some evidence that they are not effective in the long term (12 months).
* There is good evidence that NSAIDS and diuretics add no benefits on symptom improvement compared to placebo at 4 weeks, and some evidence that Vitamin B6 adds no benefit on symptom improvement compared to placebo at 10-12 weeks.

Mobilization and Manual Therapy

* There is good evidence that neuro-dynamic technique plus splinting adds no benefit on reducing pain and improving function compared to splinting alone after 3 weeks.
* There is good evidence that soft tissue mobilization plus home exercises is effective in reducing pain and improving function at 6 months.

Other Modalities

* + There is some evidence that laser acupuncture adds no benefits on night pain improvement compared to placebo at 3 weeks.
  + There is some evidence that yoga is equally effective in reducing pain and improving grip strength as wrist splinting in the short term.

Corticosteroid Injections

* + There is good evidence that a corticosteroid injection is more effective than placebo in the treatment of patients with CTS at 2 weeks and one month after treatment.
  + There is some evidence that local corticosteroid injections showed a better rate of improvement than systemic corticosteroid injections at one month after treatment.
  + There is some evidence that corticosteroid injections improve symptoms better than oral steroids at 8 and 12 weeks, but no evidence at either 2 or 80 weeks of follow-up.
  + There is some evidence that 60mg methylprednisone injection is more effective than 20 or 40mg methylprednisone at 6 months, but not at one year.
  + There is some evidence that there is no significant difference between a corticosteroid injection compared with anti-inflammatory medication plus splinting regarding pain and symptom improvement at 2 and 8 weeks after treatment.
  + There is some evidence that there is no significant difference between a single corticosteroid injection of 15mg methylprednisolone compared with 2 local corticosteroid injections regarding symptom improvement at 8, 24, and 40 weeks after injection.
* For the following nonsurgical interventions for treating patients with carpal tunnel syndrome, there is an absence of evidence for the effectiveness of;
  + A full-time use of a wrist splint compared with night-only use.
  + A wrist splint in the neutral position compared to an extended wrist position of 20° in the short term (2 weeks).
  + The addition of tendon and nerve gliding exercises to 4 weeks of night splinting compared to splinting alone.
  + Three MHz frequency of ultrasound compared with one MHz frequency in the short term.
  + Carpal bone mobilization in the short term.
  + Chiropractic therapy (manual thrusts, myofascial massage, ultrasound, and nocturnal wrist splint) compared with ibuprofen and wrist splint in the midterm.
  + Dexamethasone iontophoresis on symptom improvement compared to a placebo control group at 3 and 6 months.
  + An ergonomic keyboard compared to a standard keyboard in the short term.
  + Massage therapy, heat wrap therapy, and cupping therapy for the treatment of CTS in the short term.
  + Short-acting corticosteroid injections compared with long-acting corticosteroid injections in the short term.
  + Corticosteroid injections compared with iontophoresis or phonophoresis.

**References:**

* Garfinkel MS, Singhal A, et al. Yoga-Based Intervention for Carpal Tunnel Syndrome. JAMA 1998; 280:1601-3.
* Amirjani N, Ashworth NL, et al. Corticosteroid Iontophoresis to Treat Carpal Tunnel Syndrome: A Double-Blind Randomized Controlled Trial. Muscle Nerve 2009; 39:627-633.