

CRITICALLY APPRAISED TOPIC (CAT) WORKSHEET

Abstract:

Carpal Tunnel Syndrome (CTS) is a condition that is very common among adults and occurs when pressure is put on the median nerve in the carpal tunnel of the wrist. Symptoms include numbness, tingling, or pain in the wrist and hand that can impact an individual's participation in activities of daily living (ADLs). This critically appraised topic (CAT) aims to determine the effectiveness of wearing an orthosis and reducing pain levels for adults with CTS. Preliminary evidence was found to support the use of orthotic intervention to decrease pain levels in participants with a diagnosis of mild to moderate CTS.

Focused Question:

What is the effectiveness of orthotic intervention in pain reduction for adults with Carpal Tunnel Syndrome (CTS)?

Prepared By:

Kenzie Kuykendall, OTS (kenziekuykendall@creighton.edu)
Jocelyn Yee, OTS (jocelynyee@creighton.edu)

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Clinical Scenario:

Occupational therapists have the unique ability to holistically treat musculoskeletal conditions in the upper extremities including CTS (Roll, 2017). Occupational therapists are trained to be able to administer a wide range of interventions including preparatory tasks, occupation-based activities, and orthotic intervention for musculoskeletal conditions. The majority of CTS interventions occur through outpatient occupational therapy and/or patient education. CTS is one of the few musculoskeletal conditions that have the most literature available because it is a very common condition in adults, but expansion of clinical research is still needed (Roll, 2017). It is important for occupational therapists to utilize evidence to improve outcomes (such as pain reduction) in clients with CTS (Parish et al., 2020).

Carpal tunnel syndrome occurs when the median nerve becomes compressed at the volar wrist. This can result in weakness, numbness, or pain in the wrist and hand and can impact an individual's participation in occupational activities (National Institute of Neurological Disorders and Stroke [NINDS], 2020). In outpatient therapy, CTS is very common and affects approximately 3-6% of adults which can result in lifestyle modifications of everyday activities (LeBlanc & Cestia, 2011). CTS alone can cost railroad Maintenance-of-Way (MOW) workers between \$128.6 million to \$225.3 million in the currently diagnosed cases of CTS (Ruttenberg, 2019). Common causes of CTS include trauma or an injury to the wrist that might cause swelling (sprain or fracture), rheumatoid arthritis, fluid retention during pregnancy, or repetitive actions at the wrist (NINDS, 2020). Individuals that are at a higher risk for developing CTS include people with diabetes, metabolic disorders, and workplace factors or hobbies that contribute to repetitions that put pressure on the median nerve. Women are 3 times more likely to be diagnosed with CTS than men (NINDS, 2020). Treatment options for CTS are based on the severity. Mild CTS treatment takes 6 weeks to 3 months of conservative treatment options (LeBlanc & Cestia, 2011).

Wrist orthoses including cock-up and neutral splints along with corticosteroids are usually first-line conservative therapies for CTS (LeBlanc & Cestia, 2011). One study showed that splinting the wrist can lead to a decrease in CTS symptoms and delayed the need for surgery for up to one year (LeBlanc & Cestia, 2011). Wrist orthoses come in many different forms. The best orthosis for CTS is one that is comfortable for the patient and properly positions the wrist to prevent any compression on the median nerve (Nick Roselli Occupational Therapy [NT-OT], 2021). This can be a commercial orthosis or a custom-made orthosis by an occupational therapist. Individuals with CTS can usually see improvements in symptoms after 6 weeks of orthosis wear and therapy. Numbness and tingling can be improved or go away by 3 months (NT-OT, 2021).

Summary of Key Findings:

Summary of Levels I, II, and III

- A significant difference was noted in pain intensity for both groups with nocturnal wrist orthoses. The intervention group with the neoprene wrist orthosis had significantly lower pain intensity and mean scores on the BCTQ and lower VAS score for pain intensity than the placebo group (Eftekharsadat et al., 2017, Level I).
- The commercial orthosis reported less pain at night (3%) compared to the custom orthosis (6%). Both groups showed decreased symptom severity (Figueiredo et al., 2020, Level I).
- High outcomes were shown for the groups that were given wrist splints. Various studies showed a benefit with the wrist-cock up splint and the neutral wrist splint for pain reduction. (Healy et al., 2018, Level I).
- No significant reduction in median NPRS scale for the standard protocol that included a general cock-up splint. (Krause et al., 2020, Level I).
- A significant decrease in symptom severity with education, splinting, and exercises was shown on the Boston CTS Questionnaire (Lewis et al., 2020, Level I).
- No significant differences were found in either group for pain or symptom severity. When measuring long term effects, the steroid injection plus orthoses group showed improvements in symptom severity and functional status scores (Wang et al., 2017, Level I).

Summary of Level IV

N/A.

Contributions of Qualitative Studies:

N/A.

Bottom Line for Occupational Therapy Practice:

The clinical and community-based practice of OT:

- Occupational therapists can do more research on this intervention and may be able to suggest using non-traditional interventions such as lavender based ointments along with night splinting to patients with CTS to help decrease pain.
- Occupational therapists should use evidence to determine the best orthosis for pain reduction and function.

<ul style="list-style-type: none"> • The use of orthotic interventions is and should be used in occupational therapy to assist with decreasing symptoms of CTS by wearing the orthosis at minimum during the night while sleeping and during the day only with activities that exacerbate symptoms. • A program following a diagnosis of CTS should include education, splinting, and home exercises to get a more holistic treatment.
<p><i>Program development:</i></p> <ul style="list-style-type: none"> • If stronger evidence is found, orthotic can become part of a protocol for helping decrease pain and increase functional outcomes in clients with mild to moderate CTS. • Orthotic intervention should be an adjunctive to protocols in place for CTS patients in occupational therapy including exercises and stretches when appropriate. • Orthotic intervention should not be considered a core intervention for clients with CTS at this time, stronger evidence needs to be found.
<p><i>Societal needs:</i></p> <ul style="list-style-type: none"> • Orthotic can possibly help reduce pain (the most common symptoms that interferes with client's everyday life) due to CTS. If pain is reduced, they may not require as many doctor visits, surgeries, medication, etc. to help control the pain. • Commercial orthoses can have out of pocket costs that the patient will have to purchase custom orthosis can be covered by insurance but require a licensed therapist to fabricate. • Orthotic intervention is fairly inexpensive and can be custom made or bought commercially. Using an orthosis for CTS symptoms could decrease dependency on social programs by helping increase the patient's function and decrease in symptom severity. • Orthotic intervention should have more evidence gathered with more participants especially participants with severe CTS to be able to generalize effectiveness to this population.
<p><i>Healthcare delivery and health policy:</i></p> <ul style="list-style-type: none"> • Evidence in these studies should be considered preliminary. • Further research investigating the validity of orthotic use for CTS would be beneficial in solidifying this intervention into practice since there are some contradictions in the studies before informing policy makers. • If surgery is required for CTS, many healthcare sites have policies or protocols in place for implementation of a commercial or custom orthosis by a licensed therapist.
<p><i>Education and training of OT student:</i></p> <ul style="list-style-type: none"> • This research topic is implemented in OT school for basic topics covering interventions for CTS and could be a continuing education credit for those learning more about orthosis fabrication and recommendations for a commercial orthosis. • Orthotic fabrication is and should be part of a general, entry-level OT education as it has been shown to improve a patient's functional ability related to CTS. Continuing education or experience is needed to further advance orthotic fabrication skills. • Stronger evidence needs to be found to create a solid treatment protocol for using orthotic intervention in clients with CTS.
<p><i>Refinement, revision, and advancement of factual knowledge or theory:</i></p> <ul style="list-style-type: none"> • Further randomized control trail research of orthotic intervention is needed to have strong evidence, but some studies have shown improvements in pain for clients with mild to moderate CTS. • There is justification for the need of a large-scale study to give more power to the results and help make this something that can become part of CTS protocols.

- Studies with larger sample sizes and more diagnosis severity diversity is justified to increase the power of results.
- To reduce limitations from CTS intervention studies, state all outcome measures used and use outcome measures that are both subjective and objective.

Review Process:

- The focus question was created by the two students and reviewed by the instructor.
- Feedback was provided by the instructor/grader to narrow the outcome measures for the focus question.
- The two students revised the focus question to narrow the outcome measures.
- The students conducted a literature search using terms related to the focus question that consisted of 15 peer-reviewed scholarly articles.
- The instructor/grader reviewed the literature search and provided feedback.
- The two students each picked one scholarly peer-reviewed study from the literature search to critically appraise related to the focus question.
- The instructor/graded provided feedback to each peer-reviewed article appraisal.
- The evidence table was then created using the 6 highest-level studies from the literature search that met the inclusion and exclusion criteria related to the focus question.
- The instructor/grader provided feedback on the evidence table.
- The two students incorporated all feedback from previous assignments to best complete the critically appraised topic assignment.

Procedures for the selection and appraisal of articles:

Inclusion Criteria:

- Level I studies.
- Peer-reviewed research articles.
- Articles are within the last 5 years.
- All severities of carpal tunnel syndrome (CTS) in adults.
- Orthotic intervention with the purpose to reduce pain.

Exclusion Criteria:

- Level II-V studies.
- Studies with qualitative methods.
- Articles older than 6 years.
- Interventions that do not include orthotics.
- Participants younger than 18 years of age.
- Outcomes measures that did not include pain measures.

Search Strategy:

Categories	Key Search Terms
Patient/Client Population	Carpal tunnel, carpal tunnel syndrome, adults, CTS.
Intervention	Orthotic, orthotics, orthotic Intervention, splint, splints.
Outcomes	Pain, decreased pain, pain reduction, improved pain, less pain, lowered pain.

Databases and Sites Searched

Medline
Google Scholar
Cochrane Library
CINAHL Complete
PubMed
Academic Search Premier

Quality Control/Peer Review Process:

- The two students developed a focus questions together with feedback from the instructor to determine the specific population, intervention, and outcome.
- Library staff and resources were used to complete the search of research articles that fit all the inclusion criteria.
- Both students participated in completing the literature search through the databases and key search terms listed above.
- Feedback on literature search was given by instructor with minor corrections to design type and proper APA formatting.
- Each student completed a critical analysis paper on a research article that was included in the literature search.
- Students worked together to complete the evidence table and analyzed 6 articles that related to the focus question.
- Instructors provided feedback on the evidence table.
- All feedback from instructors was used to develop the critically appraised topic.

Results of Search:

Summary of Study Designs of Articles Selected for Appraisal:

Level of Evidence	Study Design/Methodology of Selected Articles	Number of Articles Selected
I	Systematic reviews, meta-analysis, randomized controlled trials	6
II	Two groups, nonrandomized studies (e.g., cohort, case-control)	0
III	One group, nonrandomized (e.g., before and after, pretest, and posttest)	0
IV	Descriptive studies that include analysis of outcomes (single subject design, case series)	0
V	Case reports and expert opinion, which include narrative literature reviews and consensus statements	0
	Qualitative Studies	0
		TOTAL: 6

Limitations of the Studies Appraised:

Levels I, II, and III

All studies appraised were Level I and had the following limitations:

- There were limited effects due to small sample size (Eftekharsadat et al., 2017; Figueiredo et al., 2020; Lewis et al., 2020).
- Many studies had short intervention durations that does not show long term effects (Eftekharsadat et al., 2017; Figueiredo et al., 2020; Wang et al., 2017).
- Some studies only included participants with mild-moderate CTS (Eftekharsadat et al., 2017; Figueiredo et al., 2020; Krause et al., 2020; Lewis et al., 2020).
- Some studies only not compared nocturnal vs daytime orthosis (Figueiredo et al., 2020).
- There are a wide range of outcome measures used for CTS but not reported (Healy et al., 2018).

Biases from the appraised articles that were significant:

- Co-intervention biases occurred with night orthoses, Lavendar oil, cream, and tendon & nerve gliding exercises in conjunction with commercial vs custom orthoses (Eftekharsadat et al., 2017; Figueiredo et al., 2020).
- Timing biases may have occurred with short term application of interventions including the time period of when the diaries were completed and 6-12 weeks may not have been enough time to observe long-term effects (Eftekharsadat et al., 2017; Figueiredo et al., 2020; Wang et al., 2017).
- Measurement bias may have occurred due to the fact that examiner 2 was aware of treatment diagnoses and applied the interventions to both groups (Figueiredo et al., 2020).
- Recall bias may have occurred due to outcomes measures such as the Boston CTS Questionnaire requiring participants to report symptoms severity up to 2 weeks prior to taking the questionnaire (Eftekharsadat et al., 2017; Figueiredo et al., 2020).

Levels IV and V

N/A.

Articles Selected for Appraisal:

Eftekharsadat, B., Roomizadeh, P., Torabi, S., Heshmati-Afshar, F., Joahanjoo, F., & Babaei-Ghazani, A. (2017). Effectiveness of *Lavendula stoechas* essential oils in treatment of mild to moderate carpal tunnel syndrome: A randomized controlled trial. *Journal of Hand Therapy*, 31, 437-442. <http://dx.doi.org/10.1016/j.jht.2017.07.004>

Figueiredo, D. S., Ciol, M. A., da Conceição Dos Santos, M., de Araújo Silva, L., Bidin Brooks, J. B., Santos Diniz, R. A., & Tucci, H. T. (2020). Comparison of the effect of nocturnal use of commercial versus custom-made wrist orthoses, in addition to gliding exercises, in the function and symptoms of carpal tunnel syndrome: A pilot

randomized trial. *Musculoskeletal science & practice*, 45, 102089.

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Healy, A., Farmer, S., Pandyan, A., & Chockalingam, N. (2018). A systematic review of randomised controlled trials assessing effectiveness of prosthetic and orthotic interventions. *PloS one*, 13(3), e0192094.

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Krause, D., Roll, S. C., Javaherian-Dysinger, H., & Daher, N. (2020). Comparative efficacy of the dorsal application of kinesio tape and splinting for carpal tunnel syndrome: A randomized controlled trial. *Journal of Hand Therapy*.

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Lewis, K. J., Coppieters, M. W., Ross, L., Hughes, I., Vicenzino, B., & Schmid, A. B. (2020). Group education, night splinting and home exercises reduce conversion to surgery for carpal tunnel syndrome: A multicentre randomised trial. *Journal of Physiotherapy*, 66(2), 97-104. <https://doi.org/10.1016/j.jphys.2020.03.007>

Wang, J. C., Liao, K. K., Lin, K. P., Chou, C. L., Yang, T. F., Huang, Y. F., Wang, K. A., & Chiu, J. W. (2017). Efficacy of combined ultrasound-guided steroid injection and splinting in patients with carpal tunnel syndrome: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, 98, 947-956.

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Other References:

LeBlanc, K. E., Cestia, W. (2011). Carpal Tunnel Syndrome. *American Family Physician*, 83(8), 952-958. <https://www.aafp.org/afp/2011/0415/p952.html>

National Institute of Neurological Disorders and Stroke. (2020). *Carpal tunnel syndrome fact sheet*. National Institutes of Health. <https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Fact-Sheets/Carpal-Tunnel-Syndrome-Fact-sheet>

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- Parish, R., Morgan, C., Burnett, C. A., Baker, B. C., Manning, C. & Sisson, S. K. (2020). Practice patterns in the conservative treatment of carpal tunnel syndrome: Survey results from members of the American Society of Hand Therapy. *Journal of Hand Therapy*, 33, 346-353. <https://doi.org/10.1016/j.jht.2019.03.003>
- Roll, S. C. (2017). Guest Editorial-Current evidence and opportunities for expanding the role of occupational therapy for adults with musculoskeletal conditions. *American Journal of Occupational Therapy*, 71, 71011700170. <http://doi.org/10.5014/ajot.2017.711002>
- Ruttenberg, R. (2019). The social and economic impact of carpal tunnel syndrome among maintenance-of-way employees. *Journal of Ergonomics*, 9 (1). <https://www.ninds.nih.gov/Disorders/Patient-Caregiver-Education/Fact-Sheets/Carpal-Tunnel-Syndrome-Fact-sheet>