Splinting to Reduce Upper Extremity Pain: Clinical and Cost-Effectiveness and Guidelines
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Acknowledgments:

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About CADTH: CADTH is an independent, not-for-profit organization responsible for providing Canada’s health care decision-makers with objective evidence to help make informed decisions about the optimal use of drugs, medical devices, diagnostics, and procedures in our health care system.
Research Questions
1. What is the clinical effectiveness of splinting to reduce chronic upper extremity pain?
2. What is the cost-effectiveness of splinting to reduce chronic upper extremity pain?
3. What are the evidence-based guidelines regarding splinting to reduce chronic upper extremity pain?

Key Findings
Two systematic reviews, three randomized controlled trials, and six non-randomized studies were identified regarding splinting to reduce upper extremity pain. Additionally, two evidence-based guidelines were identified.

Methods
A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2012 and June 15, 2017. Internet links were provided, where available.

Selection Criteria
One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

<table>
<thead>
<tr>
<th>Population</th>
<th>Any patient (pediatric to adult) experiencing upper extremity pain (e.g., caused by osteoarthritis, rheumatoid arthritis, carpal tunnel, etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention</td>
<td>Splinting of the upper extremity</td>
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<tr>
<td>Comparator</td>
<td>Q1-2: Opioids; No treatment; Placebo; Wait list</td>
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<td></td>
<td>Q3: No comparator</td>
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<tr>
<td>Outcomes</td>
<td>Q1: Clinical benefits and harms (e.g., pain, physical function, social function [including return to school or work], emotional and psychological functioning (e.g., anxiety, depression, sleep), health-related quality of life, opioid use, opioid prescribing practices)</td>
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<tr>
<td></td>
<td>Q2: Cost-effectiveness outcomes (e.g., incremental cost per QALY or health benefit gained)</td>
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<td></td>
<td>Q3: Evidence-based guidelines and recommendations</td>
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</tbody>
</table>

Study Designs
Health technology assessments, systematic reviews, meta-analysis, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines
Results

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines.

Two systematic reviews, three randomized controlled trials, and six non-randomized studies were identified regarding splinting to reduce upper extremity pain. Additionally, two evidence-based guidelines were identified. No health technology assessments or economic evaluations were identified.

Additional references of potential interest are provided in the appendix.

Overall Summary of Findings

Two systematic reviews, \(^1^2\) three randomized controlled trials, \(^3^5\) and six non-randomized studies \(^6^1^1\) were identified regarding splinting to reduce upper extremity pain. Five of these studies focused on wrist pain or injuries, \(^1^2^4^8^1^1\) four focused on thumb pain or injuries, \(^3^6^9^1^0\) and two focused on elbow pain or injuries. \(^5^7\) The studies examined a variety of conditions, including carpal tunnel syndrome, \(^2^4\) arthritis, \(^1^3^6^9^1^0\) lateral epicondylalgia (tennis elbow), \(^5^7\) ulnocarpal abutment, \(^8\) and joint hypermobility. \(^1^1\)

One systematic review \(^1\) examined the effectiveness of working splints for rheumatoid arthritis, finding that wrist splints reduce pain, improve grip strength, and decrease dexterity. There was insufficient evidence, however, to conclude an effect on functioning of the wrist. \(^1\)

The second identified systematic review \(^2\) examined the use of wrist splints for the treatment of carpal tunnel syndrome when compared to no treatment, placebo, or an alternative non-surgical intervention. The authors concluded that there was limited evidence to support the use of night splints when compared to no treatment in the short term. \(^2\) They also concluded that there was insufficient evidence to recommend the use of a one splint design or wearing regime over any others or to recommend other non-surgical interventions over splinting. \(^2\) Adverse events were very uncommon, with few or no patients reporting any harms associated with the use of splints. \(^2\)

Three randomized controlled trials (RCT) were identified, one focusing on thumb splinting, \(^3\) one focusing on wrist splinting, \(^3\) and one focusing on splinting for elbow pain due to tennis elbow. \(^3\) For thumb splinting for osteoarthritis (OA) pain, changes were significantly different between splinting and control groups in mean visual analog pain scores but not in the Michigan Hand Questionnaire scores or muscle cross-sectional area. \(^3\) The authors of a second RCT compared wrist splinting for carpal tunnel syndrome to a control intervention and reported significant improvements in symptom severity, duration, pain, and functionality when compared with control in patients who received wrist splinting. \(^4\) For patients with lateral epicondylalgia, the use of a wrist splint, elbow sleeve, or elbow band improved reported pain when compared with placebo; however, the sleeve and band were significantly more effective in reducing pain when compared with the wrist splint. \(^5\)
The authors of a non-randomized study also examined the use of splints for lateral epicondylalgia, with a spiral hand-forearm splint being evaluated for clinical outcomes. The splint design improved function, grip force, and pain symptoms after four weeks of use.

The authors of a second non-randomized study examined joint hypermobility and the effect wrist/hand splinting may have on pain and handwriting speed. Splinting decreased handwriting speed in three of four participants and there was no significant change in pain or endurance during the intervention. There was, however, a decrease in pain after the intervention was ceased.

The remaining non-randomized studies explored the use of custom-made splints for varying parts of the upper extremity. Three studies examined OA of the thumb joints. Splinting for OA of the trapeziometacarpal joint was reported to improve pain, muscle strength, and pinch strength with patients maintaining these improvements after 12 months follow-up. Additionally, there was a lower consumption of analgesics by participants in the study. For OA of the carpometacarpal joint, a custom neoprene orthosis improved functionality and pinch strength, pain after 30 days, and grip strength after 90 days. In another study, grip strength improved after 60 days, pain improved after 30 days, and there was additional improved functionality and pinch strength. The authors of the final non-randomized study used custom made splints to treat ulnocarpal abutment syndrome, observing that the splint improved pain, disability score, grip strength, and range of motion of the wrist.

Two evidence-based guidelines were identified regarding splinting to reduce upper extremity pain. One guideline by the American Academy for Orthopedic Surgeons provides a strong recommendation for the use of immobilization (including braces and splints) for individuals with carpal tunnel syndrome, with no adverse harm or risks expected with patient tolerance of the intervention. The second guideline by the American College of Rheumatology conditionally recommends that individuals with hand OA that include the trapeziometacarpal joint be provided with splints.

References Summarized

Health Technology Assessments
No literature identified.

Systematic Reviews and Meta-analyses


Randomized Controlled Trials


Non-Randomized Studies


Economic Evaluations
No literature identified.

Guidelines and Recommendations
See: Nonoperative treatments for Carpal Tunnel syndrome, p. 407

Appendix — Further Information

Systematic Reviews – Alternate Comparator


Randomized Controlled Trials – Alternate Comparator


Clinical Practice Guidelines – Uncertain Methodology


Review Articles


Additional References