

# Systematic Review of Ultrasound-Guided Hydrodissection Procedure for Carpal Tunnel Syndrome

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## Background

Carpal tunnel syndrome (CTS) is a common entrapment neuropathy caused by compression of the median nerve as it traverses the carpal tunnel in the wrist. Initial treatment is conservative, with splinting and corticosteroid injections being the mainstays of early management.

Many patients have persistent symptoms or go on to develop thenar atrophy, necessitating surgical release of the carpal tunnel. In patients that prefer minimally invasive intervention, ultrasound-guided hydrodissection is a novel technique that uses fluid injections under sonographic guidance to decompress the carpal tunnel. (1)

This review summarizes current evidence on the use of hydrodissection as a minimally invasive treatment approach for CTS.

## Methods

Five randomized controlled trials and five case studies were identified and reviewed in detail. The randomized controlled trials compared hydrodissection to placebo injections, oral steroids, or surgery. Five case series were identified and described technical aspects of the hydrodissection procedure, reporting outcomes on a total of 87 patients. Outcomes evaluated included symptom severity, functional status, electrophysiological testing, ultrasound imaging, and adverse events

### Inclusion Criteria:

- Population: Adults aged 18+ years diagnosed with carpal tunnel syndrome, based on clinical examination, electrodiagnostic tests, or both.
- Intervention: Ultrasound-guided hydrodissection of the carpal tunnel using any technique, injected solution, or volume
- Comparators: Placebo injection, steroid injection into the carpal tunnel, open/endoscopic surgical carpal tunnel release, or no treatment
- Outcomes: Symptom severity scores, functional status scores, grip/pinch strength, electrophysiological measurements, ultrasound imaging parameters, quality of life measures, recurrence, complication rates

### Exclusion Criteria

- Pediatric patient populations (<18 years)
- Studies assessing hydrodissection for other conditions besides carpal tunnel syndrome
- Intra-tunnel injections without ultrasound guidance
- Comparisons of different hydrodissection injectate compounds/volumes/techniques
- Non-randomized trials (observational, cohorts)

## Results

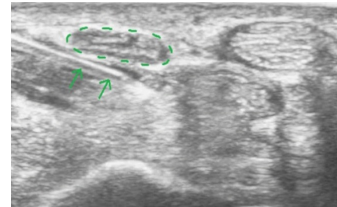
Of the 5 randomized controlled trials, 2 compared hydrodissection to placebo injections and 3 compared it to carpal tunnel release surgery. The sample sizes ranged from 20 to 87 participants.

Compared to placebo injections, hydrodissection resulted in significantly greater improvements in symptom severity scores on the Boston Carpal Tunnel Questionnaire and greater improvements in nerve conduction values at 6 weeks and 3 months follow-up in the 2 studies. (1,2,3,4)

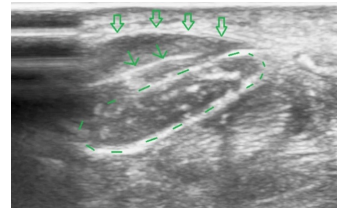
In the comparisons to surgery, hydrodissection demonstrated equivalent short-term (2 and 6 weeks) improvements in symptom scores, functional status, and ultrasound measurements of median nerve cross sectional area. Long term outcomes for surgery show 70-90% of patients had relief of symptoms and function at 1 year and 5 years, with complication rates rising to around 11% at 1 year. Long term hydrodissection outcomes were limited but revealed success rate over time. Only 25% of patients remain symptom-free at 1 year. (6,7,8,9)

All 5 hydrodissection case studies noted improvements in pain scores and symptoms within 1-6 weeks. Three series reported increased carpal tunnel width on ultrasound imaging after hydrodissection. No complications were reported with the procedures.

Axial view of ultrasound guided hydrodissection.  
Legend: circle in dotted line: median nerve; arrow: injection needle (10)



The median nerve is fully dissected from the flexor retinaculum. The anechoic fluid (on this image a layer of approximately 4 mm) between the retinaculum and the median nerve is the injected solution.  
Legend: circle in dotted line: median nerve; void arrows: flexor retinaculum or transverse carpal ligament (10)



## Discussion

This review found promising evidence that hydrodissection is a safe and effective minimally invasive treatment option for patients with carpal tunnel syndrome. The few randomized trials available indicate equivalent short-term improvements in symptoms, function, and imaging outcomes compared to surgery or steroid injections up to 2 months. Additionally, case series uniformly report reductions in pain and improved function within 1-6 weeks post-procedure. This is in line with the short term efficacy of other standard treatments like splinting, injections, and surgery.

However, several important limitations remain in the literature. The efficacy of hydrodissection beyond 8 weeks is unknown. This is a critical evidence gap, given that carpal tunnel syndrome is frequently a chronic condition. Patients and clinicians would benefit greatly from understanding longer term durability of symptom relief and functional improvements with this technique.

Lastly, current studies are overwhelmingly small case series. Larger randomized trials with active treatment controls are essential to validate results. Future research should focus on long term efficacy against surgery and steroid injections, pathophysiological effects, and optimized technique and injection protocols to help standardize the procedure.

## Conclusions

This review found promising evidence supporting the short-term efficacy and safety of hydrodissection for CTS. Randomized trials demonstrate symptom and functional improvements equivalent to surgery and steroid injections at up to 8 weeks post-injection. Case series also document reduced pain and improved function within 1-6 weeks.

However, major evidence gaps remain, most notably on long-term durability and pathophysiological impact on median nerve morphology and irritation. Additionally, larger scale randomized trials are lacking to fully validate results against standard treatments.

Current findings indicate hydrodissection improves CTS in the short-term while avoiding surgery. But additional rigorous comparative-effectiveness research is needed to elucidate its lasting effects on symptoms and function. In properly selected patients unwilling or unable to undergo surgery, hydrodissection is a low risk, minimally invasive option that expands the availability of nonsurgical techniques for carpal tunnel syndrome.

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