Academy of PHYSICAL MEDICINE

Research Paper Review

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Manual Therapy vs. Surgery for Carpal Tunnel Syndrome

European Journal of Pain 2017; 21: 1266-1276.

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ABSTRACT

INTRODUCTION: *People with carpal tunnel syndrome (CTS) exhibit widespread pressure pain and thermal pain hypersensitivity as a manifestation of central sensitization. The aim of our study was to compare the effectiveness of manual therapy versus surgery for improving pain and nociceptive gain processing in people with CTS.*

METHODS*: The trial was conducted at a local regional Hospital in Madrid, Spain from August 2014 to February 2015. In this randomized parallel-group, blinded, clinical trial, 100 women with CTS were randomly allocated to either manual therapy (n = 50), who received three sessions (once/week) of manual therapies including desensitization manoeuvres of the central nervous system, or surgical intervention (n = 50) group. Outcomes including pressure pain thresholds (PPT), thermal pain thresholds (HPT or CPT), and pain intensity which were assessed at baseline, and 3, 6, 9 and 12 months after the intervention by an assessor unaware of group assignment. Analysis was by intention to treat with mixed ANCOVAs adjusted for baseline scores.*

RESULTS*: At 12 months, 95 women completed the follow-up. Patients receiving manual therapy exhibited higher increases in PPT over the carpal tunnel at 3, 6 and 9 months (all, $p < 0.01$) and higher decrease of pain intensity at 3 month follow-up ($p < 0.001$) than those receiving surgery. No significant differences were observed between groups for the remaining outcomes.*

DISCUSSION*: The current study found that manual therapy and surgery exhibited similar effects on decreasing widespread pressure pain sensitivity and pain intensity in women with carpal tunnel syndrome at medium- and long-term follow-ups investigating changes in nociceptive gain processing after treatment in carpal tunnel syndrome.*

***CONCLUSION**: Manual therapy and surgery have similar effects on decreasing widespread pressure pain sensitivity and pain intensity in women with CTS. Neither manual therapy nor surgery resulted in changes in thermal pain sensitivity.*

ANALYSIS

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Background Information

Carpal Tunnel Syndrome (CTS) is a common condition caused by compression of the median nerve within the carpal tunnel. CTS can cause considerable pain and disability. However, recent literature has shown that CTS is also associated with widespread pain hypersensitivity, thermal pain hyperalgesia and the wind-up phenomenon (a.k.a. temporal summation) in areas outside the median nerve territory (1-3). These findings suggest that widespread sensitization is also involved in the presentation of CTS (4).

While surgery remains one of the most common treatments for CTS, only 33% of individuals who undergo surgical decompression return to work within 60 days (5). While physical and manual therapies are also advocated, there is a paucity of evidence supporting the use of exercise and mobilization as lone therapies for CTS.

Recent evidence suggests that the use of exercises targeted at desensitizing the nervous system, such as pain neuroscience education and nerve flossing, may decrease pressure and thermal sensitivity (6, 7). However, no studies conducted to date have determined whether patients who receive manual therapy or surgery for CTS exhibit positive changes in pressure pain threshold or thermal sensitivity after a course of treatment. Therefore, the purpose of this RCT was to compare the effects of manual therapy and surgery for improving pain and nociceptive gain (pain sensitivity, temperature sensitivity) in patients with CTS. The authors also sought to determine if changes in pain intensity that occur after manual therapy or surgery are associated with changes in pressure and thermal pain sensitivity.

PERTINENT RESULTS

Fifty patients were recruited for each group. Three patients from the manual therapy group and 2 patients from the surgery group did not complete the study over the 12-month follow-up period. No clinically important adverse events were reported.

A significant group x time interaction was observed for pain pressure threshold (PPT) over the carpal tunnel, but not over the median, ulnar or radial nerves, or the tibialis anterior. *Patients receiving manual therapy exhibited greater improvements in PPT over the carpal tunnel at 3, 6, and 9 months compared to those who underwent surgery ($p < 0.01$)*. The between-group effect sizes were large, in favour of the manual therapy group. Changes in PPT over the median, radial and ulnar nerves, C5-6 facet joint and tibialis anterior were positive, but similar between the groups.

Patients who received manual therapy exhibited a greater decrease in pain intensity at 3-months compared to the surgical group. The between-group effect size was large, in favour of the manual therapy group. However, no significant between-group differences were observed at 6, 9 and 12 months. Both groups exhibited large within-group effect sizes at all follow-up periods.

There were no significant changes in heat pain threshold or cold pain threshold in either group. Thus, there was no association between changes in pain intensity, and changes in pressure or thermal pain sensitivity.

CLINICAL APPLICATION & CONCLUSIONS

The authors performed a randomized clinical trial to compare the effectiveness of manual therapy and surgery for improving pain and nociceptive gain (hot and cold pain threshold and pressure-pain threshold - HPT, CPT and PPT, respectively) in female patients with CTS. *Manual therapy, consisting of multisite soft tissue therapy and desensitization exercises targeting the CNS, had similar positive effects on pressure pain sensitivity and pain intensity in women with CTS compared to surgery*. Thermal pain sensitivity was unchanged in both groups at the mid- and long-term follow-up periods. Interestingly, the manual therapy group exhibited a greater decrease in pain intensity at 3-months follow-up and significant improvements in PPTs over the carpal tunnel at 3, 6 and 9 months (discussed further below).

It is hypothesized that the neurophysiological effects of manual therapy are related to its ability to modulate CNS pain processing, as manifested in this trial by reduction in pressure sensitivity (or, an increase in PPT). The changes in PPT over the carpal tunnel surpassed the minimal detectable differences proposed by Walton et al. (8); these results suggest that a localized hypoalgesic effect specifically over the carpal tunnel after multimodal manual therapy occurred.

Neither group demonstrated any change in thermal pain sensitivity. The lack of change

(particularly in CPT) perhaps indicates that neither intervention reversed any intrinsic median nerve damage at the carpal tunnel.

Both groups demonstrated significant and clinically important decreases in CTS pain intensity from baseline to follow-up, particularly at the 6, 9 and 12-month follow-up time periods. *(REVIEWER'S NOTE: this indicates that both subjective ratings of pain intensity and a local change in pressure pain threshold were observed in both groups).* The between-group differences were not significant at mid-to-long-term follow-up. However, the *manual therapy group exhibited a greater decrease in pain intensity at 3-month follow-up, compared to the surgery group (this may have something to do with recovery from the surgery itself?).* Unfortunately, the clinical significance of the between group difference in pain intensity at the 3-month follow-up period is uncertain, given the confidence interval that was statistically measured. There was no association between changes in clinical pain intensity and changes in PPT or thermal pain sensitivity.

The results of this study have potential implications for clinical practice: the use of the manual therapy program in this trial had equal outcomes to surgery at mid- to long-term follow-up. This result is different from previous studies showing that carpal tunnel decompression surgery provides superior long-term outcomes to conservative treatment for CTS. However, previous studies comparing these two interventions have primarily used localized interventions such as splints, laser, ultrasound or injections. Based on these results, a trial of conservative care is undoubtedly indicated.

STUDY METHODS

This RCT recruited females from a local regional hospital with clinical and electrophysiological findings of CTS. Patients were randomly assigned to the manual therapy or surgical decompression groups.

Inclusion Criteria:

- Pain and parasthesiae in the distribution of the median nerve;
- > 6 months symptom duration;
- positive Tinel's sign;
- positive Phalen's sign; and
- electrodiagnostic evidence of sensory-motor median nerve conduction deficit.

Exclusion Criteria:

- Any sensory and/or motor deficit in the radial and/or ulnar distribution;
- patients > 65 years of age;
- previous wrist surgery or steroid injection;
- multiple upper extremity diagnoses (i.e. co-existing radiculopathy);
- previous history of neck, shoulder or hand trauma;
- CTS related to a specific disease (i.e. Diabetes, thyroid disease);

- comorbid MSK/medical conditions (i.e. Rheumatoid arthritis, fibromyalgia);
- pregnancy; or
- male gender.

The severity of CTS was graded as mild (abnormal segmental-comparative tests only), moderate (abnormal median nerve sensory velocity conduction and distal motor latency), or severe (absence of median nerve and abnormal motor latency), based on physical and electrophysiological findings.

Patients undergoing manual therapy received a 30-minute treatment session once weekly, which included various CNS desensitization manoeuvres. The desensitization procedures consisted of soft tissue mobilization directed at various median nerve entrapment sites (scalenes, pec minor, biceps brachii, bicipital aponeurosis, pronator teres, wrist flexors, palmar aponeurosis, transverse carpal ligament and lumbricals [9]) and nerve/tendon gliding exercises for the median nerve. The application of soft tissue techniques to the abovementioned areas was based on physical findings of tenderness to palpation and reproduction of neurological symptoms. The nerve/tendon gliding exercises were applied in the following pattern: shoulder girdle depression, glenohumeral abduction and lateral rotation, forearm supination, and extension of the wrist, thumb and fingers (10). After the 3 sessions, patients were given instructions on how to perform the nerve/tendon gliding exercises at home, twice daily.

The patients allotted to the surgery group underwent endoscopic decompression and release of the carpal tunnel. Patients in this group also received the same education sessions for performing the nerve/tendon gliding exercises as the manual therapy group.

The primary outcome was pressure pain threshold (PPT) over the median, radial and ulnar nerves, C5-6 facet joint, carpal tunnel and tibialis anterior. PPT was measured using an electric algometer and increased at a rate of 30 kPa/s. Patients were instructed to press the switch when the sensation of pressure turned to pain. Secondary outcomes included the current, highest and lowest ratings on the 11-point Numerical Pain Rating Scale (NPRS) the preceding week, and thermal pain sensitivity. The mean value of scores was used for the analysis at each follow-up. The most severe hand was used in the case of bilateral symptoms (if pain was equivalent, both hands were used). A change of 2-points on the NPRS, or a 30% decrease in pain intensity from baseline were considered to be a meaningful change. Thermal pain thresholds were tested bilaterally over the carpal tunnel and thenar eminence. Patients were instructed to press a switch when the sensation of heat/cold turned to a sensation of heat/cold pain. Three trials were performed and averaged on each point. No side-to-side difference was found in heat pain or cold pain thresholds (HPT/CPT), and as such, scores were pooled from both sides for the analysis. Patients were asked to report any side effects from any intervention.

Statistical Analysis:

The authors used an intention-to-treat analysis. Mean, standard deviations and/or 95% confidence intervals were calculated for each variable. Baseline demographics and clinical variables were compared between both groups using an independent Student t-test for continuous data, and X2 tests of independence for categorical data. The primary evaluation was a repeated measures analysis of covariance (ANCOVA). Standardized mean score differences (SMDs) were calculated to enable comparison of effect sizes. Generally, a p-value of < 0.05 was considered statistically significant. However, a post-hoc Bonferroni test concluded an alpha-level of 0.01 should be used. Several Pearson product-moment correlation coefficients were used to determine the relationship between changes in pain intensity and changes in the remaining variables. A linear regression analysis was performed between those variables showing a significant association with trial outcome changes.

STUDY STRENGTHS/WEAKNESSES

Weaknesses:

- The application of nerve gliding exercises was performed homogeneously. While a homogeneous application of this technique is of benefit in a research context, it may not work as well clinically. Classically, neurodynamic techniques suggest applying tension *closer* to the area of entrapment first, and not just distally-to-proximally.

- The study population only included females. It is this unknown whether similar results would be found in men.

- Other idiopathic reasons for CTS were not excluded in the study.

- Only 3 sessions of manual therapy were applied, which may not reflect the needs and progression of patients in an average manual therapy setting.

- No spinal/extremity manipulation nor mobilization was included as part of the manual therapy intervention - this may have further improved the outcomes in the manual therapy group.

- No other psychosocial outcomes were collected (i.e. depression, anxiety, sleep etc.).

- The neurophysiological studies were not retested. It remains uncertain, therefore, whether manual therapy can change electrodiagnostic findings.

Strengths:

- The study was statistically sound and well-powered.

- The authors measured and reported on adverse effects.

- The authors compared a multimodal and pragmatic manual therapy approach to a commonly used surgical intervention for CTS, which allows for generalizability to clinical practice.

- Different physical therapists and surgeons participated in the management of women in this clinical trial, which also enhanced generalizability.

- Long term follow-up was conducted and they achieved a high retention rate throughout the study.

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