Outcomes of Carpal Tunnel Surgery With and Without Supervised Postoperative Therapy

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Purpose: To assess if a formal 2-week hand therapy improves outcomes and justifies its expense.

Methods: A prospective randomized study was completed using a contemporary short incision and a 2-week program of therapy. Patients were randomized into 2 treatment groups: one group received instruction on home therapy exercises to be followed after carpal tunnel release, and a second group received the home program in addition to a therapist-directed program for 2 weeks. Variables measured were patient age, gender, preoperative and postoperative pain scores, grip and pinch strengths, return to modified and regular work, insurance coverage, and job category. Both groups were followed for 6 months postoperatively.

Results: One hundred fifty patients (110 women and 40 men) entered and completed the study. The average age was 46 years (range, 29–70 years). The average age, gender distribution, insurance coverage, and breakdown of job categories between groups was not statistically significant. There was no difference in return to work times between those with and without postoperative therapy; however, patients covered by workers' compensation insurance were slower to return to both modified and regular work compared with the other groups. The postoperative grip and pinch strengths, pain and Disabilities of the Arm, Shoulder, and Hand scores did not show statistical differences between groups at any of the measured time periods. Depending on insurance carrier, directed therapy added $600 to $900 to the cost of care.

Conclusions: The current randomized study failed to show benefit in a 2-week course of hand therapy after carpal tunnel release using a short incision. The cost of supervised therapy for an uncomplicated carpal tunnel release seems unjustified. (J Hand Surg 2007;32A: 1159–1163. Copyright © 2007 by the American Society for Surgery of the Hand.)

Type of study/level of evidence: Prognostic I.

Key words: Carpal tunnel syndrome, therapy, outcomes.

Carpal tunnel syndrome is frequently treated surgically. Limited palmar incisions or endoscopic carpal tunnel releases are commonly used. Hand therapy is used postoperatively by many practitioners, but there are few studies that document its usefulness.[1] Other studies have found therapy to be of limited or no benefit.[2–4] There is increasing interest in providing cost-effective care. Indiscriminate use of therapy may dramatically increase overall cost for treatment. A prospective randomized study was performed using a contemporary short incision and a 2-week program of therapy. It is the purpose of this study to assess if formal hand therapy improves outcomes and justifies its expense.

Materials and Methods

One hundred fifty consecutive patients were entered into the study between 2002 and 2006. There were 110 women and 40 men who completed the study (Table 1). The gender difference between groups was not statistically significant (Student's *t*-test, $p > .05$). No patient who met entry criteria for the study failed to participate, and all patients who met entry criteria were consecutive over the study period. No patients

Table 1. Demographic and Clinical Data

	Therapy	No Therapy
Number of patients	73	77
Average age	47	45
Male %	35	37
Medicare	8	9
Commercial insurance	47	46
Workers' compensation	20	20
Sedentary job	24	24
Light job	25	25
Medium job	15	15
Heavy job	8	8
Very heavy job	3	3

were lost to follow-up, and none crossed over between groups. A sample size was calculated based on a primary outcome measure of a 1.4 kg difference in pinch and 2.3 kg difference in grip measurements using a power of 85% with an .05 significance level.

Entry criteria met by all patients were a clinical evaluation consistent with the disorder (pain and paresthesias in the hand primarily in the radial digits, awakening at night due to hand pain and numbness, positive timed Phalen's or carpal compression test[5]), absence of cervical pathology, lack of clinical signs of advanced disease (atrophy of the thenar muscles, dense anesthesia in the median innervated digits), no prior surgery on the hand or wrist, absence of arthritis of the hand or wrist, no prior or concurrent history of endocrine disorders (diabetes mellitus, thyroid disorders), and a nerve conduction study confirming the diagnosis and the patient employed at the time of surgery. No patient who met the entry criteria during the time of the study was excluded. Institutional review board approval was obtained for the study to be completed.

Once patients met the entry criteria, they were then randomized into 1 of 2 groups by having a staff member not involved in the study blindly draw a paper from a box. The box had equal numbers of marked and unmarked papers. Those with a mark were randomized to a 2-week course of therapy as described by Nathan et al.[1] The patients with unmarked papers were randomized to a group without formal therapy.

Both groups were instructed preoperatively that there would not be any restrictions to motion of the operated hand and wrist and no splints would be used after surgery. They were instructed preoperatively in differential tendon gliding exercises and scar massage. Return to their desired activity or work was discussed with all patients preoperatively and timing was based on job duties. They were all allowed to be off work until the first postoperative visit. At that visit, return to work was allowed in all patients; job modifications, if any, were based on upper extremity requirements. No bilateral surgeries were performed. A small incision and dressing as described by Bromley[6] was used in all patients. No tenosynovectomy, epineurotomy, or neurolysis was performed in any patient. Patients were instructed that they could remove the dressing the following day if desired and shower, replacing the postoperative dressing with a standard adhesive bandage strip. They were informed to avoid direct pressure over the incision and to keep the incision clean. Sutures were removed at the first office visit in 5–7 days, and patients were encouraged to use the hand for activities of daily living. They were encouraged to increase hand use. In those patients randomized to the therapy group, a prescription for a 2-week therapy course, 6 sessions (nerve glide exercises, range of motion, and strengthening), was added.

After the first office visit, patients were allowed to return to modified activity avoiding any forceful gripping or direct pressure over the incision site. They were advanced to full activities or work during subsequent visits unless there were complications from the surgery. In patients who did not have the option of modified duty due to the policy of their employer, they were off work until their symptoms and clinical evaluation allowed unrestricted work.

Patients were then evaluated every 2 weeks for the next month. If patients were not back to their regular job or activities by 6 weeks, an additional office visit was scheduled in 2 weeks. Otherwise, follow-up was at 3 and 6 months after surgery. The 6-month follow-up time was chosen as Guyette and Wilgis have shown that persistent clinical signs and symptoms of carpal tunnel syndrome fail to improve after 6 months postoperatively.[7] Outcomes measured included time to return to work, pain, and pinch and grip strength. Disability was measured by the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire.

In patients who were employed at the time of surgery, return to work dates were recorded for both modified and regular duty. Jobs were classified according to the Dictionary of Occupational Titles into sedentary, light, medium, heavy, and very heavy categories.[8] The job breakdown for the commercial insurance was 35 sedentary, 36 light, 20 medium, and 2 heavy. Workers' compensation job breakdown was 10 light, 10 medium, 14 heavy, and 6 very heavy

jobs. The Medicare job breakdown was 13 sedentary and 4 light-duty positions.

At each office visit, clinical evaluation was completed by staff blinded to whether or not the patient was in formal therapy. Examination included wound evaluation, lateral pinch using a Preston pinch gauge (JA Preston Corporation, Clifton, NJ), and grip using a dynamometer at position II[9] (Asimov Engineering Corporation, Los Angeles, CA) as described by Mathiowetz et al.[10] All patients had preoperative strength measurements recorded. An analog 10-point pain scale was administered preoperatively and postoperatively. A score of 0 translated to no pain, whereas severe pain was given a score of 10. Patients were questioned for persistence of nocturnal symptoms, paresthesias, and incision difficulties, if any. At the final office visit, patients completed the DASH questionnaire.

Results

Return to modified work occurred after the first office visit in 80 of 93 patients with commercial insurance, 15 of 40 patients with workers' compensation coverage, and 12 of 17 patients with Medicare coverage. Regular-duty work was achieved by 6 weeks in 79 of 93 commercial insurance patients, 30 of 40 workers' compensation patients, and 17 of 17 Medicare patients. By 8 weeks postoperatively, the remaining patients covered by commercial insurance had returned to their regular jobs. At 8 weeks, 3 additional workers' compensation patients had returned to regular duties. The remaining 7 patients returned to regular duty by 12 weeks postoperatively (Table 2). There was no difference in return to work times between those with and without postoperative therapy (Student's *t*-test, $p > .05$); however, patients covered by workers' compensation insurance were slower to return to both modified and regular work compared with the other groups (2-tailed *t*-test, $p > .05$).

Table 2. Return to Work Data by Insurance Coverage

	Therapy	No Therapy
Medicare		
After first visit	5	7
After 6 weeks	8	9
After 8 weeks	8	9
Commercial		
After first visit	38	42
After 6 weeks	38	41
After 8 weeks	45	48
Workers' compensation		
After first visit	8	7
After 6 weeks	16	14
After 8 weeks	18	15
After 12 weeks	19	21

Table 3. Postoperative Grip and Pinch Strength Measurements

	Grip/Pinch, kg Average (SD)	
	Therapy	No Therapy
	(N=73)	(N=77)
2 weeks	19.1 (10.6)/4.1 (2.3)	19.8 (10.0)/4.8 (2.2)
4 weeks	24.0 (9.0)/5.6 (2.0)	23.8 (9.9)/5.6 (2.2)
6 weeks	24.8 (9.2)/6.9(2.5)	24.7 (9.0)/7.0 (2.4)
3 months	26.0 (8.9)/7.5(2.3)	26.6 (8.8)/7.7 (2.5)
6 months	26.2 (10.0)/7.6 (2.3)	26.6 (9.9)/7.8 (2.3)

Preoperative grip and pinch strength averages for the study group were 25.5 kg (SD 10.8 kg) and 7.4 kg (SD 2.3 kg), respectively. The postoperative grip and pinch strength measurements did not show any statistical differences at any of the measured time periods (Student's *t*-test, $p > .05$) (Table 3). Preoperative pain averaged 6 of 10 and 1 of 10 postoperatively for both groups. DASH scores averaged 19 (SD $\pm$17) for the therapy group and 18 (SD $\pm$17) for the nontherapy group. There was no significant statistical difference in pain complaints or DASH scores in the patients with or without postoperative therapy (Student's *t*-test, $p > .05$).

The payment for therapy varied between insurance carriers. Each therapy session was approximately one-half hour with a certified hand therapist along with any additional modalities (massage, fluidotherapy, etc) used at each session. Medicare paid the lowest for therapy at approximately $100 per visit. Workers' compensation paid the highest at approximately $150 per visit. Commercial insurance reimbursement varied by the contract provisions of the plan but averaged approximately $125 per visit among the 6 plans surveyed in the study group. For the 2 weeks of therapy, this added from $600 (Medicare) to $900 (workers' compensation) to the cost of patient care compared with those patients who did not have formal therapy (Table 4).

There were 3 complications. All 3 patients had a wound dehiscence when sutures were removed at 5 days postoperatively. None required resuturing. All were closed in the office with sterile adhesive strips and went on to uneventful healing. All were patients 60 years of age or greater. One patient was in therapy and covered by commercial insurance and two were covered by Medicare and were not enrolled in formal therapy.

Table 4. Cost of Care: Carpal Tunnel Syndrome by Insurer

	Surgery	Therapy	Total
Medicare	$442	$600	$1,042
Commercial*	$540	$750	$1,290
Workers' compensation	$2,300	$900	$3,200

*Average of 6 different commercial plans in Northern Illinois.

Discussion

Carpal tunnel syndrome is one of the most common surgically treated disorders of the hand and wrist. Postoperative hand therapy is ordered to maximize outcome, despite limited studies in the literature to assess the benefit of therapy.[1–4] Only one study[3] used randomization. There is ever increasing interest in documenting measurable benefit for interventions used to treat medical disorders. We attempted a randomized, blinded study to assess the effectiveness of a 2-week course of therapy as outlined by Nathan et al.[1]

By the measures evaluated (grip and pinch strength, return to work, postoperative pain, and DASH scores), there was no difference between patients who did and did not receive formal postoperative hand therapy. Our results are in agreement with others[3,4] who found that postoperative supervised hand therapy did not improve outcomes in comparison with patients who did not have this intervention. The patients in our study did not return to work earlier as had been noted by different investigators.[1,2] Possible reasons may be study design, different patient populations, work environments, job classifications, and preoperative patient education on return to work expectations in our study, among others. These factors also highlight the shortcomings in using return to work as a variable to evaluate outcome. A home-directed physiotherapy program has been used by previous authors with success.[11] It appears the patients can complete home exercises with little difficulty.

We did not have any data on the indirect costs of therapy attendance (e.g., the cost of transportation to and from therapy and time lost from work during therapy attendance). It appears intuitive that there are indirect costs. This would make the expenses in the therapy group even higher than for those who completed a home program.

A limitation of our study may have been our using the DASH questionnaire as an outcome instrument. There have been studies showing the Carpal Tunnel Questionnaire and the Michigan Hand Questionnaire (MHQ) to be more responsive in symptom relief.[12,13] However, the DASH questionnaire was chosen due to its familiarity to most surgeons, its ease of administration, and its being shown to be sufficiently responsive for use in outcome studies of carpal tunnel syndrome done 12 or more weeks from surgery.[12,14] The ideal outcome measurement tool after carpal tunnel surgery has not been agreed on. An additional limitation in its use was its not being administered prior to the institution of surgery, which would have provided further useful data.

Using current reimbursement rates, the cost of therapy approximately doubles the professional cost of treatment (therapy plus surgeon's fee) for Medicare and commercial plans. For all carriers in this study except workers' compensation in Illinois, the cost of therapy is equivalent to the surgeon's fee despite there being no benefit in the parameters measured. This disparity would increase with greater amounts of therapy other than the 6 visits used currently. There is no dispute as to the benefit of a carpal tunnel release in patients with documented carpal tunnel syndrome. The additional expense of therapy was not justified in the current study.

A criticism of our study may be that the optimal therapy program for a short incision carpal tunnel release may not have been used. Using the current study regimen, 100% of employed Medicare-covered workers returned to full duty by 6 weeks as did 85% of those covered by commercial insurance and 75% of those patients covered by workers' compensation coverage. Also, there was no difference in pinch and grip strength measures at any evaluation time. If additional therapy is used and its costs are greater, this would have to be balanced against the benefits achieved, both direct and indirect. Additionally, the number of patients needed to bring a statistically significant increase in the time to return to full duty may also be greater than the 150 used in the current study.

In summary, the routine use of postoperative hand therapy for patients having contemporary small open incisions in the treatment of carpal tunnel syndrome uncomplicated by coexisting conditions such as arthritis, endocrinopathies, or advanced disease was not supported by the current study. Further investigation will be needed to clarify which patients with other comorbidities, if any, may benefit from hand therapy after the surgical treatment of carpal tunnel syndrome.

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