Single-Portal Endoscopic Carpal Tunnel Release Compared with Open Release

A PROSPECTIVE, RANDOMIZED TRIAL

BY THOMAS E. TRUMBLE, MD, EDWARD DIAO, MD, REID A. ABRAMS, MD, AND MARY M. GILBERT-ANDERSON, MA

Investigation performed at the Department of Orthopaedics, University of Washington Medical Center, Seattle, Washington; the Department of Orthopaedic Surgery, University of California, San Francisco, California; and the Department of Orthopaedics, University of California, San Diego, California

Background: Carpal tunnel syndrome is a common condition causing hand pain and numbness. Endoscopic carpal tunnel release has been demonstrated to reduce recovery time, although previous studies have raised concerns about an increased rate of complications. The purpose of this prospective, randomized study was to compare open carpal tunnel release with single-portal endoscopic carpal tunnel release.

Methods: A prospective, randomized, multicenter center study was performed on 192 hands in 147 patients. The open method was performed in ninety-five hands in seventy-two patients, and the endoscopic method was performed in ninety-seven hands in seventy-five patients. All of the patients had clinical signs or symptoms and electrodiagnostic findings consistent with carpal tunnel syndrome and had not responded to, or had refused, nonoperative management. Follow-up evaluations with use of validated outcome instruments and quantitative measurements of grip strength, pinch strength, and hand dexterity were performed at two, four, eight, twelve, twenty-six, and fifty-two weeks after the surgery. Complications were identified. The cost of the procedures and the time until return to work were recorded and compared between the groups.

Results: During the first three months after surgery, the patients treated with the endoscopic method had better Carpal Tunnel Syndrome Symptom Severity Scores, better Carpal Tunnel Syndrome Functional Status Scores, and better subjective satisfaction scores. During the first three months after surgery, they also had significantly ($p < 0.05$) greater grip strength, pinch strength, and hand dexterity. The open technique resulted in greater scar tenderness during the first three months after surgery as well as a longer time until the patients could return to work (median, thirty-eight days compared with eighteen days after the endoscopic release). No technical problems with respect to nerve, tendon, or artery injuries were noted in either group. There was no significant difference in the rate of complications or the cost of surgery between the two groups.

Conclusion: Good clinical outcomes and patient satisfaction are achieved more quickly when the endoscopic method of carpal tunnel release is used. Single-portal endoscopic surgery is a safe and effective method of treating carpal tunnel syndrome.

Open carpal tunnel release has been considered the operative procedure of choice for decompression of the median nerve at the wrist in patients who have idiopathic carpal tunnel syndrome[1-5]. However, while excellent results have been reported, some authors have suggested that persistent weakness, tenderness of the scar, and pain in the thenar or hypothenar area (pillar pain) occur frequently after open procedures[6-10]. In a review of all cases of occupational carpal tunnel syndrome in the state of Washington between July 1, 1987, and December 31, 1987, Adams et al. reported a mean loss of work time of four months, with only ninety-seven (67%) of 144 patients able to return to their original job[11]. Endoscopic release of the carpal tunnel was introduced as an alternative method in the hope of decreasing the rate of these complications[12-15]. There are two endoscopic techniques for carpal tunnel release: single-portal and two-portal[12-16]. Both may offer advantages compared with open carpal tunnel release by diminishing the frequency and severity of tenderness of the scar and pillar pain and allowing patients to return to work more quickly[12,17-19]. We are aware of two prospective, random-

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ized clinical trials comparing the endoscopic and open methods. Before releasing a device for the single-portal method, Agee et al.[12] completed a prospective trial with a three-month follow-up. Brown et al.[2] performed the only independent randomized trial (to our knowledge) of the two-portal technique, with an eighty-four-day follow-up. In both of these preliminary reports, the authors expressed concern that the endoscopic technique may have a higher rate of complications. Palmer et al.[19] reported a prospective, nonrandomized study, with a six-month follow-up, comparing the open method, the single-portal technique, and the two-portal technique. They noted that both endoscopic techniques allowed an earlier return to work than the open technique did, but the two-portal technique resulted in more complications. Since these initial studies were carried out, there have been technical improvements in the endoscopic techniques, and subsequent reports have demonstrated fewer complications[20-22]. However, no independent prospective, randomized trial comparing the single-portal technique with the open technique has been conducted, to our knowledge, since many of these technical improvements have become available. Previous investigators did not use validated outcome questionnaires that allow an accurate measurement of patient satisfaction and correlate results with quality of life, return to work, and physical parameters[23-25]. Furthermore, standardized functional tests that evaluate dexterity and the ability to use the hand were not used in any prior studies[26-29].

The purpose of the present prospective, randomized, multicenter, blind-assessment outcome study was to compare the results of single-portal endoscopic carpal tunnel release with those of open carpal tunnel release with use of validated outcome questionnaires, standardized functional tests, and physical measurements.

Materials and Methods

One hundred and forty-seven patients, treated at three institutions, were identified as having idiopathic carpal tunnel syndrome. Forty-five patients had bilateral involvement, so the study included a total of 192 hands. The diagnosis of carpal tunnel syndrome was made on the basis of pain, paresthesias, and/or weakness in the distribution of the median nerve at the wrist.

The Tinel and Phalen provocative tests were used to assist in the diagnosis[30]. Electrophysiological confirmation was established with use of the combined sensory index, which is the sum of three latency differences: median-ulnar across the palm (palmdiff), median-ulnar to the ring finger (ringdiff), and median-radial to the thumb (thumbdiff)[31,32]. All patients included in the study met the American Association of Electrodiagnostic Medicine diagnostic criteria for carpal tunnel syndrome[31-33].

All patients either had failure of nonoperative management, consisting of the use of a wrist splint and/or injections of a steroid compound into the carpal canal, or refused such a program. The duration of preoperative treatment, for the patients who consented to it, was as long as ten years, depending on the presenting symptoms, the objective findings, and the response to the nonoperative measures[34]. Patients who had recurrent or acute carpal tunnel syndrome, inflammatory arthropathy, or documented peripheral neuropathy, or who were pregnant, were excluded from the study. No patient with diabetes had concomitant evidence of diabetic peripheral neuropathy. Patients under the age of eighteen years or over the age of seventy-five years were also excluded, to meet the guidelines of the human subjects committees. All patients gave written informed consent to participate in the study.

Demographic Data

All patients: Initially, 161 patients (209 hands) were enrolled in the study. However, six patients (eight hands) in the endoscopic group and eight patients (nine hands) in the open-release group were lost to follow-up after less than one year and were excluded from the study. The average age of the 147 patients remaining in the study was fifty-six years (range, twenty-four to seventy-four years). There were ninety-five women and fifty-two men. The dominant hand was involved in 106 patients. The duration of symptoms before the operation averaged thirty-two months (range, four months to eleven years). One hundred and two patients (127 hands) worked outside the home, and forty-five patients (sixty-five hands) worked at home or were retired.

Endoscopic group: There were seventy-five patients (ninety-seven hands) in this group. The mean age was fifty-six years, and the dominant hand was involved in fifty-three patients. Forty-eight of the patients were female. The mean duration of symptoms was twenty-eight months (range, four months to eight years). Fifty-three patients (seventy hands) worked outside the home. Forty-four patients (fifty-eight hands) had made a Workers' Compensation claim that had been approved. Forty-seven patients had been treated with a splint for six weeks prior to the surgery. Sixteen patients had been treated with a steroid injection.

Open-release group: There were seventy-two patients (ninety-five hands) in this group. The mean age was fifty-six years, and the dominant hand was involved in fifty-three patients. Forty-seven of the patients were female. The mean duration of symptoms was thirty-one months (range, four months to eleven years). Forty-nine patients (fifty-seven hands) worked outside the home, and forty patients (fifty-one hands) had made a Workers' Compensation claim that had been approved. Fifty-five patients had been treated with a splint for six weeks prior to the surgery. Twenty-one patients had been treated with a steroid injection prior to the surgery.

Assessment

An observer independent of the surgical team performed an assessment before each patient was randomly assigned to a treatment group. For the postoperative assessment, the observer, a research assistant, was blinded to the type of procedure by placement of a stockinette over the patient's hand, as described by Brown et al.[2]. Preoperatively, the patients completed the Carpal Tunnel Syndrome Symptom Severity Score (CTS-SSS) and the Carpal Tunnel Syndrome Functional Status

Score (CTS-FSS)[23,35,36]. These questionnaires ask the patient to rate symptoms on a scale of 1 to 5, with 1 representing the fewest symptoms or the least functional difficulty. The mean scores are reported. Overall satisfaction was rated on a visual analog scale ranging from 1 to 5. Digital sensibility was measured with use of two-point-discrimination and Semmes-Weinstein monofilament tests. The patients were assessed for the presence of thenar atrophy, and the strength of the abductor pollicis brevis was graded on a scale of 0 to 5, according to the criteria of the American Orthopaedic Association[37]. The grip strength of the involved and uninvolved hands was measured with use of all five settings of the Jamar dynamometer (Asimov Engineering, Los Angeles, California). The maximum grip was used for the statistical analysis. Key and three-jaw chuck-pinch strength were determined with a pinch meter (Therapeutic Instruments, Clifton, New Jersey). To evaluate dexterity, the patients performed a Jebsen-Taylor hand function test and a Purdue pegboard test prior to surgery. With the Jebsen-Taylor hand function test, an examiner monitors the time that it takes for a patient to complete activities that demonstrate dexterity and coordination using small and large objects[26,38]. The Purdue pegboard test involves the placement of small metal pegs into a standardized board, with the number of objects correctly placed in sixty seconds recorded to provide a comparison of preoperative and postoperative values[28]. Normal values have varied by age and gender in published tables[39-41].

Postoperatively, the questionnaires and the measurements of strength and sensibility were repeated, in a blinded fashion, at two, four, eight, twelve, twenty-six, and fifty-two weeks. In addition, scar sensitivity was measured with use of a specially constructed plunger that applies loads of up to 3.0 kg to three regions: at the level of the distal wrist crease, 2.0 cm proximal to the wrist crease, and 2.0 cm distal to it (Fig. 1). The loads were applied for thirty seconds at each location, and the lowest load that produced discomfort was recorded.

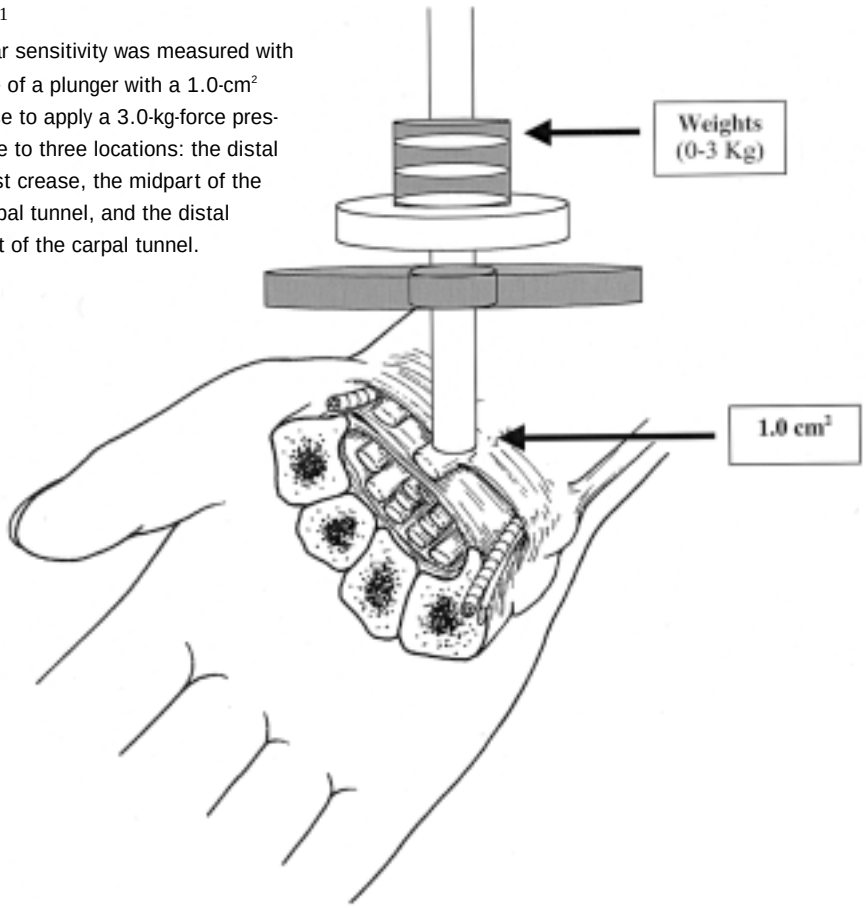


Fig. 1

Scar sensitivity was measured with use of a plunger with a 1.0-cm² base to apply a 3.0-kg-force pressure to three locations: the distal wrist crease, the midpart of the carpal tunnel, and the distal part of the carpal tunnel.

Randomization

Approval for patient participation in the study was obtained from the human subjects committee or internal review board of each hospital. After the decision to proceed with carpal tunnel release had been made, the procedure to be performed was determined by drawing a randomly assigned marked slip of paper from an envelope. Patients with bilateral carpal tunnel syndrome had the procedure that had been randomly assigned to the first hand performed on the contralateral hand as well because Agee et al.[12] demonstrated that patients with bilateral disease will not agree to have a different procedure done on each hand.

Operative Method

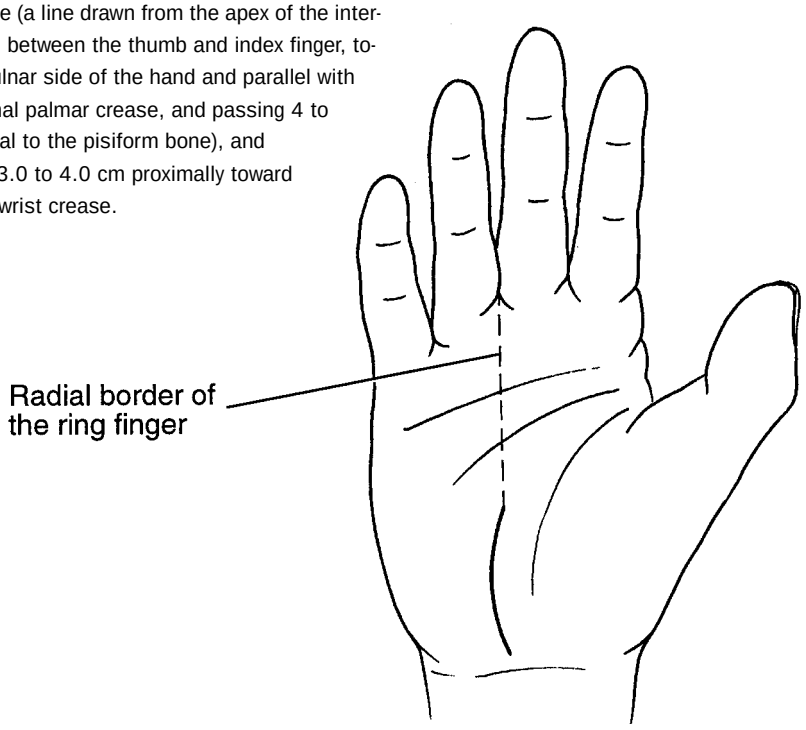
Before the initiation of the study, each surgeon had practiced the technique of endoscopic carpal tunnel release on cadavera and had also performed the procedure clinically. Three surgeons, one from each center, were involved in the study. The number of hands operated on by each surgeon before the study ranged from twenty to 400. The procedures were routinely performed with regional anesthesia.

Open carpal tunnel release: The incision is made 2 mm ulnar to the thenar crease, just distal to the Kaplan oblique line (a line drawn from the apex of the interdigital fold between the thumb and index finger, toward the ulnar side of the hand and parallel to the proximal palmar crease, and passing 4.0 to 5.0 mm distal to the pisiform bone), and extended 3.0 to 4.0 cm proximally toward the distal wrist crease (Fig. 2). The superficial palmar fascia, transverse carpal ligament, and antebrachial fascia are divided under loupe magnification. The tourniquet is deflated after the wound is closed with monofilament sutures. In this series, neither tenosynovectomy nor neurolysis was performed.

Single-portal endoscopic carpal tunnel release: A device designed by Agee, to

Fig. 2

For the open release, the incision is made 2 mm ulnar to the thenar crease, just distal to the Kaplan oblique line (a line drawn from the apex of the interdigital fold between the thumb and index finger, toward the ulnar side of the hand and parallel with the proximal palmar crease, and passing 4 to 5 mm distal to the pisiform bone), and extended 3.0 to 4.0 cm proximally toward the distal wrist crease.



minimize the scarring in a patient who was dependent on crutches, was used[12]. A 1.0-cm transverse incision is made at the level of the distal wrist crease in the center of the volar aspect of the wrist. The incision is centered over the palmaris longus if it is present. The palmaris longus is retracted radially to protect the palmar cutaneous branch of the median nerve. Scissors are used to make a distally based flap in the flexor retinaculum. The median nerve is identified deep to the retinaculum, and a synovial elevator is used to reflect the synovial tissue from the undersurface of the transverse carpal ligament (Fig. 3). Dilators are used to provide a space for the Agee device (3M, St. Paul, Minnesota). The device is inserted to a depth of <3.0 cm to avoid injury to the superficial palmar arch or the common digital nerve to the fourth web space (Fig. 4). The sheath of the device is maintained tightly against the transverse carpal ligament to protect the median nerve. Once the device is in place, its trigger is depressed to elevate the blade, and then the device is withdrawn to release the transverse carpal ligament. Several passes may be required when the transverse carpal ligament is very thick. A Ragnell retractor is used to protect the distal skin edge from laceration by the blade of the device (Fig. 5). The forearm flexor retinaculum can be released under direct vision with scissors. The incision is closed with monofilament sutures.

Time and Cost

The time from inflation of the tourniquet to transport of the patient from the operating room was recorded for each procedure. Surgeon's fees, anesthesia fees, and costs of equipment (including endoscopy blades) as well as operating-room and all other costs incurred by the patient on the day of the operation were recorded. Intravenous regional anesthesia was used routinely at all three study sites, which helped to standardize the costs.

Postoperative Regimen

Postoperatively, the hand was placed in a bulky dressing; no splints were used. The patients were allowed to use the hand for light activities for the first two weeks after surgery. At two weeks, the dressings and sutures were removed and the patients were instructed to perform a specific written set of hand exercises. No hand therapy was prescribed unless there were early signs of reflex sympathetic dystrophy; two patients had such signs after open release.

Statistical Analysis

Analysis of covariance was performed for comparison of outcomes at each post-

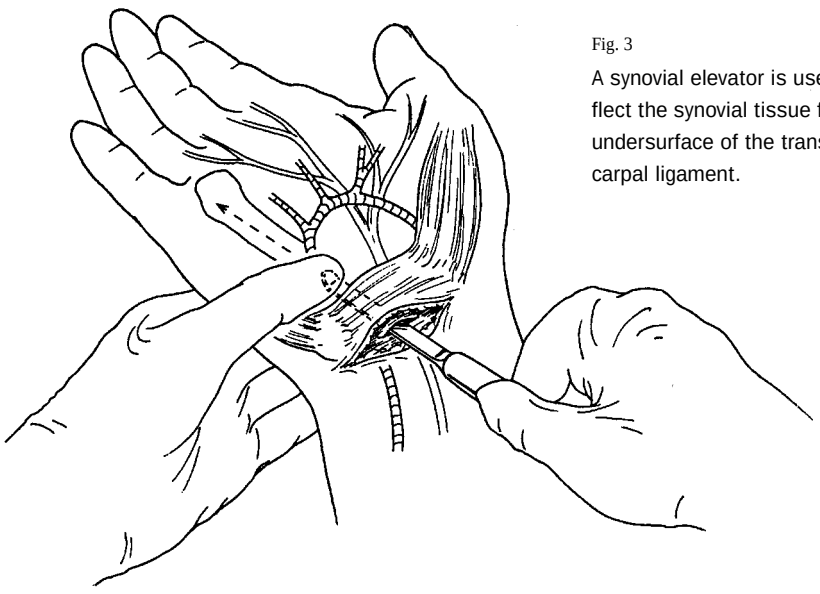


Fig. 3

A synovial elevator is used to reflect the synovial tissue from the undersurface of the transverse carpal ligament.

operative interval. Repeated-measures analysis of covariance were used to compare the results of the two groups. Cochran-Mantel-Haenszel tests were used to compare ordinal values, and Kaplan-Meier survivorship analysis was used to compare return to work and function. The quantitative variables are reported as means and standard deviations. The reported p values are two-sided. Power analysis was performed so that, for continuous variables, there was an 80% chance of detecting a significant difference ($p < 0.05$) if the true difference was as great as 0.4 times the standard deviation.

Results

Patient Demographics

Seventy-two patients (ninety-five hands) had open carpal tunnel release, and seventy-five patients (ninety-seven hands) had endoscopic carpal tunnel release. We found no significant differences between the two groups with respect to age, gender, handedness, duration of symptoms, electrodiagnostic findings, frequency of outside work, number of Workers' Compensation claims, or bilaterality.

Electrodiagnostic Studies

Preoperatively, the sensory latency averaged 4.6 msec and the motor latency averaged 5.6 msec in the endoscopic group. In the group treated with open carpal tunnel release, the sensory latency averaged 4.9 msec and the motor latency averaged 5.5 msec. Electromyograms demonstrated positive findings in nine hands (seven patients) in the endoscopic group and eleven hands (ten patients) in the open-release group.

Outcome Measurements

Preoperatively, the Carpal Tunnel Syndrome Symptom Severity Score averaged 3.1 for the patients in the open-release group and 3.2 for the patients in the endoscopic group (Table I). In both groups, the scores improved throughout the follow-up period, with a mean fifty-two-week score of 1.8 in each group. However, at two weeks, four weeks, two months, and three months, the patients in the endoscopic group had significantly lower (better) scores ($p < 0.01$).

The Carpal Tunnel Syndrome Functional Status Score averaged 2.7 preoperatively in both groups. The score improved continuously throughout the follow-up period in the endoscopic group. However, in the open-release group, improvement was not noted until the fourth week and significant differences from the endoscopic group were noted at the two-week, four-week, two-month, and three-month follow-up periods ($p < 0.01$). Ultimately, the score in both groups improved to 1.7.

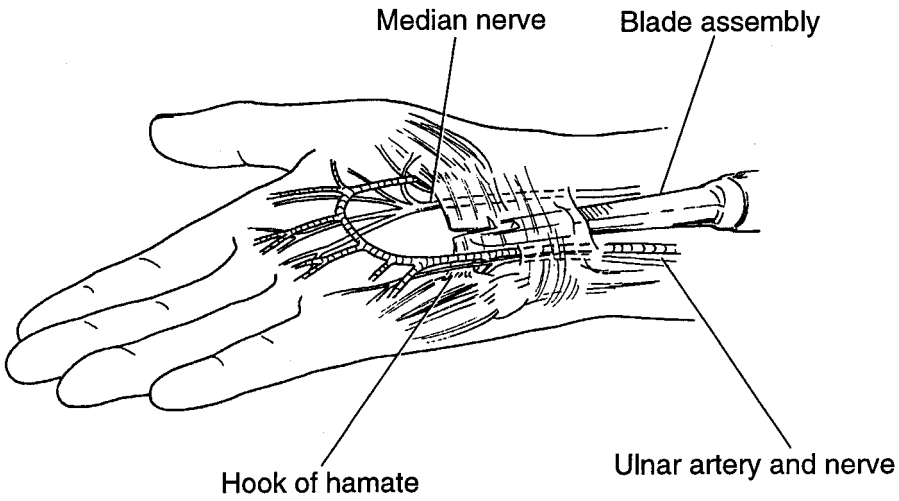


Fig. 4

The Agee device is inserted into the carpal canal until the distal end of the ligament is visualized.

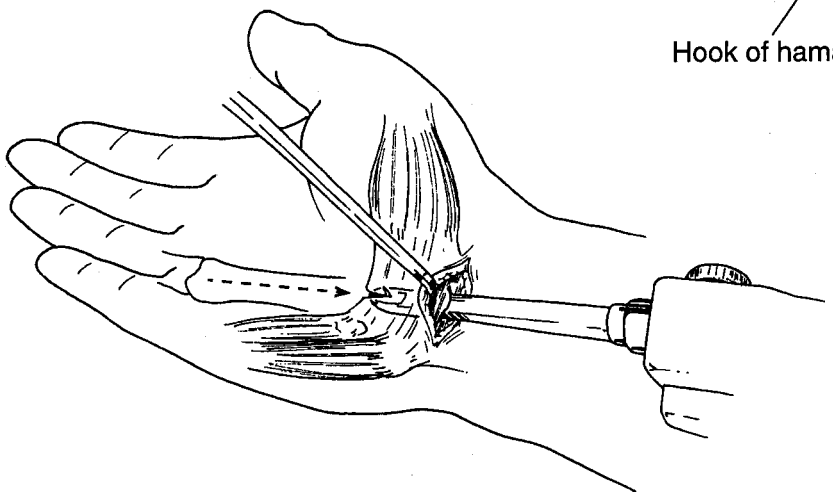


Fig. 5

A Ragnell retractor is used to protect the skin edge as the Agee device is withdrawn during the release of the transverse carpal ligament.

TABLE I Outcome Measures

	Symptom Severity Score		Functional Status Score		Satisfaction Score	
Weeks	Endoscopic	Open	Endoscopic	Open	Endoscopic	Open
0	3.2 ± 0.14	3.1 ± 0.13	2.7 ± 0.12	2.7 ± 0.08		
2	2.3 ± 0.15	3.1 ± 0.15*	2.2 ± 0.11	3.0 ± 0.11*	4.2 ± 0.13	3.3 ± 0.13*
4	2.0 ± 1.4	3.0 ± 0.12*	1.9 ± 0.11	2.6 ± 0.08*	4.2 ± 0.14	3.4 ± 0.12
8	1.9 ± 0.12	2.7 ± 0.13*	1.9 ± 0.13	2.5 ± 0.12*	4.3 ± 0.12	3.6 ± 0.13
12	1.8 ± 0.14	2.5 ± 0.11*	1.7 ± 0.1	2.4 ± 0.1*	4.4 ± 0.13	4.0 ± 0.14
26	1.7 ± 0.13	1.8 ± 0.1	1.8 ± 0.13	1.8 ± 0.09	4.5 ± 0.12	4.5 ± 0.12
52	1.8 ± 0.15	1.8 ± 0.1	1.7 ± 0.1	1.7 ± 0.11	4.6 ± 0.11	4.5 ± 0.13

*The value was significantly different from the corresponding value in the endoscopic group ($p < 0.01$ for the Carpal Tunnel Syndrome Symptom Severity and Functional Status Scores and $p < 0.05$ for the satisfaction score).

The overall patient satisfaction score was quite good, even at the two-week follow-up point, at which time it was 4.2 in the endoscopic group and 3.3 in the open-release group, which was a significant difference ($p < 0.05$). Both groups had a gradual increase in satisfaction until the twenty-six-week follow-up interval. At one year, the patient satisfaction scores were 4.6 in the endoscopic group and 4.5 in the open-release group, which was not a significant difference.

Evaluation of Sensation

Prior to surgery, the mean score for the Semmes-Weinstein monofilament evaluation of the median nerve distribution was 4.17 in the open-release group and 4.19 in the endoscopic group. Postoperatively, the sensation in both groups improved significantly ($p < 0.05$) but no significant difference was found between the two groups ($p = 0.26$), a finding that was similar to that of Agee et al.[12]. The final sensibility measured 3.26 in the endoscopic group and 3.20 in the open-release group.

Scar Sensitivity

Preoperatively, both groups could withstand loads of up to 3.0 kg without discomfort. Two weeks after surgery, the endoscopic group tolerated loads of 2.3 kg whereas the open-release group tolerated loads of 1.3 kg ($p < 0.05$). In the endoscopic group, the scars remained significantly less tender than those in the open-release group until the third postoperative month. Even at a year after surgery, both groups had equally mild persistent scar tenderness.

Grip and Pinch Strength

Preoperatively, the grip strength averaged 31 kg in the endoscopic group and 33 kg in the open-release group. Two weeks after surgery, the grip strength had decreased significantly in both groups ($p < 0.05$), to 21 kg in the endoscopic group and to 15 kg in the open-release group. The patients in the endoscopic group then recovered grip strength faster than did those in the open-release group until the three-month follow-up examination ($p < 0.05$), when the grip strengths in both groups approached preoperative levels. At the time of final follow-up, the patients in the open-release group had a grip strength of 34 kg and those in the endoscopic group had a grip strength of 32 kg. The findings for key pinch strength paralleled those for grip strength. Preoperatively, the patients in the endoscopic group had a key pinch strength of 7.3 kg, and the patients in the open-release group had a key pinch strength of 7.4 kg. At the two-week follow-up evaluation, key pinch strength had decreased to 6.2 kg in the endoscopic group and to 5.7 kg in the open-release group ($p < 0.05$). Both groups continued to improve with regard to this variable, although the patients in the endoscopic group improved more quickly. By the third postoperative month, the final key pinch strength (7.9 kg in the endoscopic group and 8.1 kg in the open-release group) exceeded the preoperative value in both groups.

The preoperative three-jaw chuck-pinch strength averaged 6.5 kg in the endoscopic group and 4.7 kg in the open-release group. The endoscopic group had faster recovery of this strength ($p < 0.05$) until the third postoperative month, when the strength exceeded the preoperative measurement in both groups. At the final follow-up evaluation, the three-jaw chuck-pinch strength was 6.9 kg in the endoscopic group and 6.7 kg in the open-release group.

Purdue Pegboard and Jebsen-Taylor Dexterity Tests

Preoperatively, the mean composite Jebsen-Taylor score was forty-one seconds in the series as a whole. At the two-week postoperative evaluation, the mean score had increased to fifty-seven seconds in the open-release group and to fifty-one seconds in the endoscopic group. The endoscopic group continued to improve more quickly than the open-release group ($p < 0.05$) until the three-month follow-up period, when both groups had a mean score of forty-four seconds. At the final follow-up evaluation, the endoscopic group had a score of

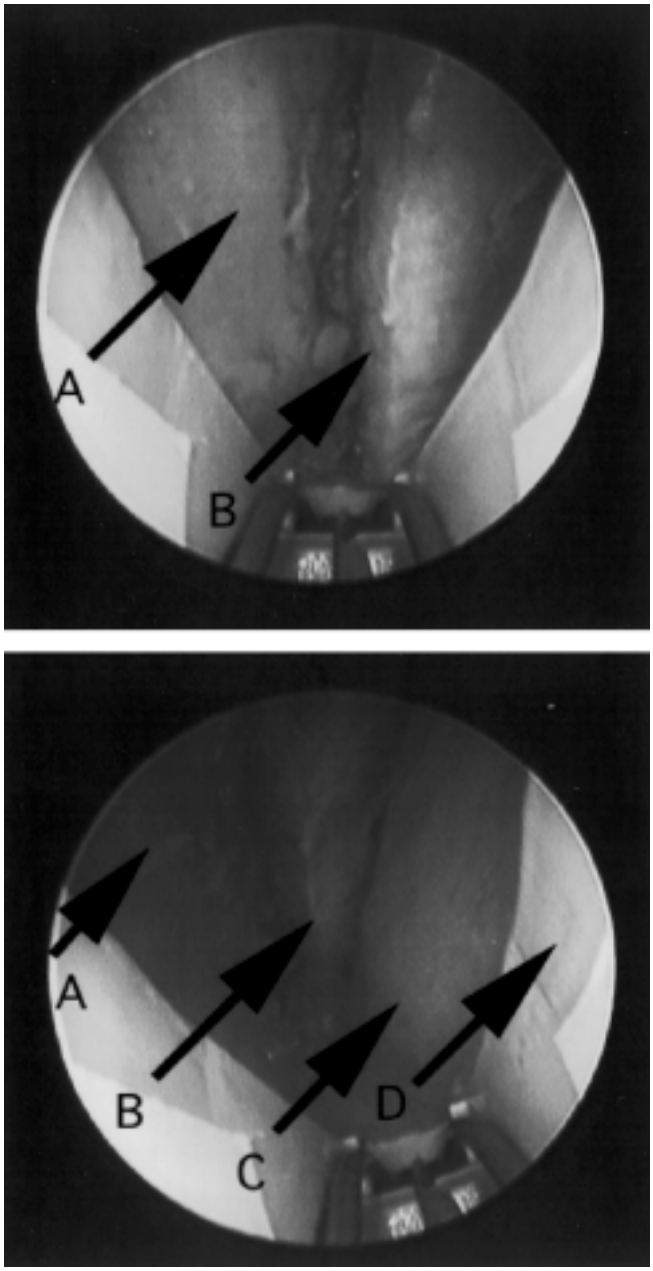


Fig. 6

This intraoperative photograph demonstrates the intact soft tissues that include the palmar fascia and the palmaris brevis muscle (A) and the cut edge of the ligament (B) (top view) as well as the median nerve (C) (bottom view), which is immediately adjacent to the Agee device (D) once the device has been rotated after the release to visualize the nerve.

thirty-nine seconds and the open-release group had a score of forty-one seconds.

Neither group showed significant improvement in the ability to perform the Purdue pegboard test until four weeks after surgery. Prior to surgery, the endoscopic group had a score of sixteen pegs and the open-release group had a score of eighteen pegs. Two weeks after surgery, the endoscopic group had a score of eleven pegs and the open-release group had a score of twelve pegs. At four weeks, the scores were seventeen and thirteen pegs, respectively, which was a significant difference ($p < 0.05$). By the third postoperative month, both groups had a score of twenty pegs, which did not improve further during the remainder of the study.

Return to Work

The median time until the patients returned to work was thirty-eight days (range, fourteen to eighty-four days) in the open-release group compared with eighteen days (range, three to fifty-six days) in the endoscopic release group; this was a significant difference ($p = 0.0086$). All of the forty-five patients who had bilateral carpal tunnel release had the procedures performed at different times, and their ability to return to work after each procedure was rated separately.

Time and Cost

The mean time from the administration of anesthesia to the removal of the patient from the operating room was forty-two minutes in the endoscopic group and forty-nine minutes in the open-release group. The mean cost was $3940 for the open carpal tunnel releases and $3750 for the endoscopic carpal tunnel releases. There was no significant difference in overall cost.

Complications

None of the patients had a nerve or artery injury. Symptoms consistent with reflex sympathetic dystrophy, with swelling, redness, and increased sweating, developed in two patients in the open-release group. In one, the symptoms were mild and resolved after a brief course of physical therapy. In the other patient, the symptoms were more protracted and a regular therapy program as well as the use of nortriptyline was required. The patient ultimately returned to her regular work. One patient treated with an open carpal tunnel release required revision surgery because of persistent symptoms, which resolved following the second operation. Electrodiagnostic studies of this patient demonstrated latency periods that actually were more prolonged than the preoperative latency periods. This occurred even though a 1-cm separation of the segments of the transverse carpal ligament had been documented at the initial operation.

None of the fourteen patients (seventeen hands) who were excluded from the study because of inadequate follow-up had complications that we could determine from a chart review.

Discussion

Endoscopic carpal tunnel release was introduced to reduce the morbidity associated with the open method of carpal tunnel release. Several studies have indicated that the endoscopic method provides relief of numbness and paresthesias in a similarly high percentage of patients and that both procedures are highly effective[12-16].

Analysis of the primary outcomes in this study demonstrates that the patients who had undergone endoscopic release had greater relief of symptoms, improvement in function, and satisfaction for the first three months following the surgery. Furthermore, they had faster recovery of both grip and pinch strength, findings that agree with those in the nonrandomized study performed by Palmer et al.[19].

Previous studies have suggested that open carpal tunnel release is associated with considerable morbidity, including prolonged tenderness of the scar and weakness of grip for as long as three to six months after the operation[7,8,10,42,43]. The rationale for the development of the endoscopic method was to improve the major functional outcomes (tenderness of the scar, grip strength, activities of daily living, and return to work). In our study, tenderness of the scar was found to be greater in the patients in the open-release group than in those who had undergone endoscopic release. We presume that a major factor in this regard is the fact that the palmaris brevis muscle and the palmar fascia are not divided with the endoscopic technique but are with the open-incision technique (Fig. 6).

One of the most important functional outcomes is the interval between the operation and the patient's resumption of activities of daily living and work. In one previous study, industrial employees lost an average of fifty-four days of work after open carpal tunnel release[43]. In contrast, Chow, who retrospectively studied the results of endoscopic carpal tunnel release in 456 patients, noted that 269 (59%) returned to normal activity and work after two weeks and 392 (86%) returned after four weeks[13]. As in previous studies of endoscopic carpal tunnel release[2,12,13], our patients with a single-portal endoscopic release returned to work earlier than did those with an open release.

The safety of the endoscopic technique has been a major concern. Although one isolated report focused on the risks involved in endoscopic surgery[44], these findings were not borne out in larger, prospective, multicenter trials[12,19,20]. No complications occurred with the endoscopic technique in our study. Three patients in the open-release group had complications, but all three had resolution of those symptoms either with therapy or with revision carpal tunnel release. The two factors that we think reduced the rate of complications were the achievement of adequate anesthesia and a team that was familiar with fiberoptic-assisted surgery.

This study provides evidence that endoscopic surgery can be performed as fast as open surgery without an increased prevalence of complications. As a result, endoscopic release does not increase medical expenses and can decrease socioeconomic costs because the patient returns to work in a shorter period of time. We concluded that endoscopic carpal tunnel release is a safe and cost-effective technique that, compared with open carpal tunnel release, improves patient outcome in the first three months following treatment. ■

Thomas E. Trumble, MD
Mary M. Gilbert-Anderson, MA
Department of Orthopaedics, Box 356500, 1959 N.E. Pacific Street, University of Washington Medical Center, Seattle, WA 98195. E-mail address for T.E. Trumble: trumble@u.washington.edu

Edward Diao, MD
Department of Orthopaedic Surgery, University of California, San Francisco, 500 Parnassus Avenue, MU-320-West, San Francisco, CA 94143

Reid A. Abrams, MD
Department of Orthopaedics, University of California, San Diego, 350 Dickinson Street, Mailcode 8894, San Diego, CA 92103

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