The Egyptian Journal of Hospital Medicine (October 2025) Vol. 101, Page 4764-4770

Surgical Outcome of Proximal Incision of Carpal Tunnel Release

Mohammud Ahmud Salim[1], Hossam Elnoamany[1], Mohammed Dorrah[1*], Ahmed Sleem[2], Ahmed Said Mansour[1]

[1]Neurosurgery Department, Menoufia University Hospitals, Menoufia University, Menoufia, Egypt

[2]Neurosurgery Department, Nasser Institute for Research and Treatment, Cairo, Egypt

***Corresponding Author: Mohammed Dorrah, e-mail: Mohammeddorrah@med.menofia.edu.eg,**

ORCID number: 0009000282425258, Tel: +201024579196

ABSTRACT

Background: Carpal tunnel syndrome (CTS) is the most common peripheral nerve compression disorder affecting the upper extremities worldwide. It develops as a result of median nerve compression at the wrist. Release of the transverse carpal ligament by an extended longitudinal incision is the classical performance of the open method. A variety of minimally invasive techniques were introduced for the purpose of preventing the classical method's complications. Transverse carpal ligament sectioning is typically performed with generic tools. A minimally invasive technique with short longitudinal palmar incision and an original knife was introduced by Avci and Sayli with satisfactory outcomes. This article analyzes the pain, healing, and the proximal incision complications of carpal tunnel release.

Patients and Methods: A Prospective and retrospective study was conducted to evaluate the outcome of proximal incision in carpal tunnel syndrome release during the period from 12/2022 to 12/2024. The study included 32 patients. We used the pre- and post-operative Boston Carpal Tunnel Syndrome Questionnaire (BCTQ), also referred to as the Levine scale, to evaluate the recruited participants.

Results: Improvement of symptoms (burning, numbness, and worse night time pain) were noticed to all (32) operated patients. There was an extensive improvement of total pain and function score. No recurrence of symptoms for more surgery was reported by the patients. No other significant issues were identified.

Conclusion: The proximal transverse incision for carpal tunnel release is superior because it isn't limited in practice. Pain is minimal and it heals fast with no significant complications. It also appears better, is less tense, and reduces the risk of problems with touch. The resolution of the symptoms was significant.

Keywords: Carpal tunnel syndrome, Proximal transverse incision, Carpal tunnel release, Entrapment Neuropathy.

INTRODUCTION

Carpal tunnel syndrome is the most prevalent compression disorder of the nerves in the upper extremities and occurs at a frequency of around 3.46 per 1,000 persons [1].

It occurs when the median nerve is compressed where it travels through the wrist, although increased pressure within the carpal tunnel could be contributing factor. Compression affects the normal blood supply of the median nerve and causes specific symptoms of numbness, tingling, and muscle weakness [2].

Studies show that risk factors for CTS are determined more by work activities and gender and that the risk for CTS is higher for women compared with men by a factor of four [3]. The classical method of transverse carpal ligament release involves a full incision throughout the Kaplan cardinal line or over the wrist crease. Although this method enables surgeons to treat coexistent ailments such as carpal fractured displacements, osteophytes, and ganglions, it entails a number of limitations such as scar pain, late healing, esthetic concerns, and weakened pinch force through inter thenar fascia split [4,5].

The hyperesthesia surrounding the incision zone of the palm are known as pillar pains. In order to overcome these limitations, a variety of minimally invasive techniques have been developed that preserve subcutaneous tissue disruption and thus minimize the risk for neuropathic pain complications [6]. Endoscopic techniques, in particular, can reduce postoperative pain and restore function back to normal faster. Nevertheless, the latest advancements are associated with several limitations: the use of costly equipment, prolonging the surgery period, steeper learning curves, and the possibility of an incompetent division of the transverse carpal ligament, potentially higher recurrence rates [7].

Research on cadavers [8] has shown that endoscopic techniques failed to completely release the transverse carpal ligament in 38% of specimens. Nevertheless, both mini-open and endoscopic approaches preserve the inter thenar fascia, potentially helping maintain pinch strength [9]. Some surgeons prefer open techniques with smaller incision, either palmar or carpal-performing median nerve decompression through limited-open or mini-open blind procedures [10,11].

Limited-open techniques have become the standard approach for carpal tunnel release. These methods allow surgeons to directly view the entire transverse carpal ligament through a short longitudinal incision (3-4 cm), typically dividing the ligament with conventional instruments like scalpels or scissors [12].

Avci and **Sayl** [11] developed a minimally invasive technique utilizing a short longitudinal palmar incision

Received: 02/05/2025
Accepted: 04/07/2025

and a specialized knife, reporting favorable outcomes with minimal complications. Their procedure begins with a skin incision, followed by subcutaneous tissue division to expose the distal edge of the flexor retinaculum. The specialized knife is then inserted in a distal-to-proximal direction for blind division of the retinaculum.

Bhattacharya and colleagues [13] conducted a randomized controlled trial comparing **Avci** and **Sayli's** [11] knife technique with traditional open CTR to assess potential benefits in reducing scar tenderness and pillar pain but found no significant differences between approaches. Another randomized study involving 39 patients using the same specialized knife demonstrated promising initial results [14].

MATERIALS AND METHODS

Prospective and retrospective study were done to evaluate the outcome of proximal incision in carpal tunnel syndrome release during the period of one year from 12/2022 to 12/2024. This study was approved by Menoufia University Faculty of Medicine Research and Ethical Committee with IRB no 3/2024 NEUS 19-1. Informed consent was taken from all participants who were informed of all aspects of the study and agreed to participate, they have also the right to give up as they wanted. The study included 32 patients. We collected the data of age and gender. Also, we gathered information preoperatively about the duration of symptoms, nerve conduction velocity, and time of surgery. Postoperatively, we searched for improved symptoms, searched for pillar pain, the time of suture removal and post-operative complications. We used Pre and postoperative Boston Carpal Tunnel Syndrome Questionnaire (BCTQ), also referred to as the Levine scale[15], of the recruited participants.

Inclusion criteria: Moderate and severe cases of carpal tunnel syndrome.

Exclusion criteria:

1- Cases of rheumatoid arthritis, tenosynovitis and diabetic neuropathy.
2- Mild cases of carpal tunnel syndrome.
3- Peripheral vascular diseases, e.g Raynaud's disease.

Ethical approval: The Menoufia Faculty of Medicine's Institutional Review Boards (IRB) provided their approval. The date and IRB approval number are 3/2024 NEUS 19-1. In addition to this consent, information was obtained from Menoufia University's Neurosurgery Department and Each participant gave their consent after being fully informed about the study and given the freedom to discontinue participation at any time. All information is private and was utilized exclusively for the study. The co-investigators and the primary investigator will adhere to the ethical standards derived from the "Declaration of Helsinki."

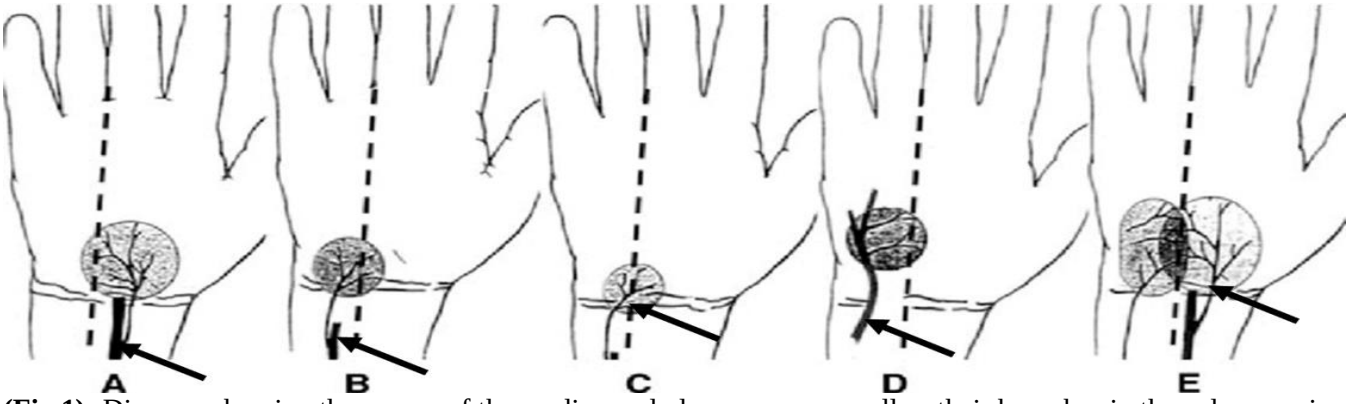
Statistical Analysis: Data were collected, tabulated, and statistically analyzed using an IBM personal computer with Statistical Package of Social Science (SPSS) version 20 **(IBM Corporations, 2011),** Armonk, NY and Epi Info 2000 programs, where the following statistics were applied. **Descriptive statistics**: in which quantitative data were presented in the form of mean **($\overline{X}$),** standard deviation **(SD)**, range, median and interquartile range, and qualitative data were presented in the form of numbers and percentages **(%)** and were tested for normality using the Kolmogorov-Smirnov test, the Shapiro-Wilk test.

Analytical statistics: For comparing the same group on different times **Paired T test** was used for quantitative parameter variables, and the Wilcoxon test was used for non-parametric data

- P-value of (>0.05) was considered not statistically significant.
- P-value of (≤0.05) was considered statistically significant.
- P-value of (≤0.001) was considered statistically highly significant.

Surgical technique:

The procedure was performed under either general anesthesia or regional anesthesia with tourniquet control. While brachial block was the preferred method, general anesthesia was administered to patients who declined the block. During surgery, the wrist was maintained in an extended position. For anatomical reference, a vertical line was drawn from the third interdigital space to the wrist crease on the palm, while a horizontal line connected the radial aspect of the thumb to the styloid process (Kaplan cardinal line) (Fig. 1). The incision site was marked as a 2 cm horizontal line at the wrist crease, where it intersected with the base of the vertical line. The surgeon made a 2 cm horizontal incision along one of the proximal wrist creases. After cutting through skin and subcutaneous tissue, the ligament was exposed (Fig. 2). This was followed by subcutaneous dissection of the antebrachial fascia, along with ventral and dorsal dissection of the transverse carpal ligament. The ligament was then cut using scissors under direct visualization. The entire retinaculum, including the palmar fascia, was visualized and divided under direct observation. The procedure concluded with simple skin closure. (Fig. 3).



(Fig 1): Diagram showing the course of the median and ulnar nerves as well as their branches in the palmar region and Vertical line was drawn from the third interdigital space to wrist crease on the palm. **(A)** The median nerve**(B)** The ulnar nerve**(C)** The nerve of Henle**(D)** Transverse palmar cutaneous branches of the ulnar nerve. **(E)** The palmar cutaneous branch of the median nerve.

(Fig 2): Skin and subcutaneous tissue were cut, and ligament was visualized.

(Fig 3): Direct skin closure was done.

RESULTS

We have operated on 32 patients. The mean age of the patients was 48.3±9.5 SD years (range 25-62 years) (Table 1).

Table 1: Sociodemographic data of the selected participants (no=32)

Item	Frequency(no=32)	Percentage
Gender		
Males	7	21.9
Females	25	78.1
Age in years		
Mean ± SD	48.3±9.5	
Min- max	25-62	
Median (IQ)	47.5(43.3-57)	

Preoperatively, the mean duration of symptoms of the patients was 8.8±3.9 SD months (range, 3-21months), respectively 25 cases of them were females and 7 of them was males which may be related to housework because all of females were Egyptian housewives. The mean of median nerve conduction velocity latency was 4.7±0.67 SD (Table 2).

Table 2: Disease related characteristic of the selected participants (no=32)

	Item	Frequency (no=32)	%
Duration of symptoms (months)	Mean ± SD Min- max Median (IQ)	8.8±3.9 3-21 7(6-12)	
Nerve condition velocity (milliseconds)	Mean ± SD Min- max Median (IQ)	4.7±0.67 3.9-6 4.6(4.1-5)	
Time of surgery (min)	Mean ± SD Min- max Median (IQ)	9.6±1.8 7-12 10(8-11)	
Improved symptoms	Yes No	32 0	100.0 0.0
Pillar pain	Yes No	14 18	43.8 56.2
Time of sutural removal	Mean ± SD Min- max Median (IQ)	10.2±3.01 7-20 9(8-12)	
Complication	Infection None	2 30	6.3 93.7

The mean of the operative time of surgery was about 9.6±1.8 SD minutes. Postoperatively, all cases showed improved symptoms such as burning sensation, numbness and night pain exacerbation. There was postoperative pillar pain in 43.8% of patients, and that was temporarily improved gradually in about 4 months in all cases. That were shown. The data collected pre-and postoperatively according to the Boston Carpal Tunnel Syndrome Questionnaire (BCTQ)of the recruited participants were presented in (Table 3).

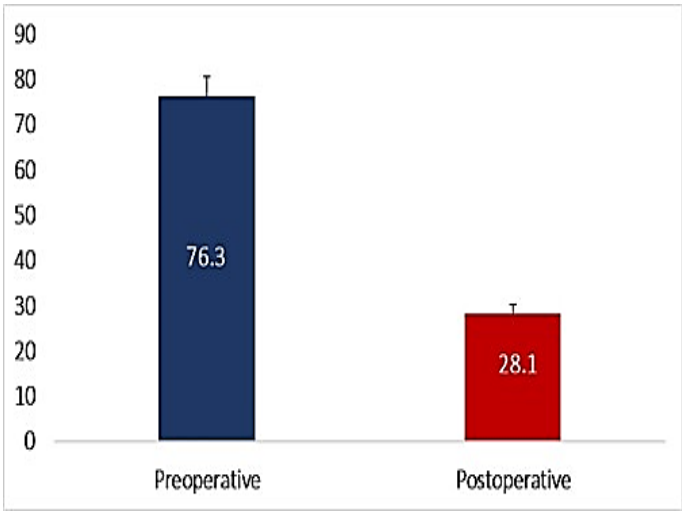
Table 3: Pre and postoperative Boston Carpal Tunnel Syndrome Questionnaire (BCTQ) of the recruited participants (no=32)

Item	Preoperative	Postoperative	Test of significance and p-value
Total score			
Mean ± SD Min- max Median (IQ)	76.3±4.3 67-84 76.5(74-79)	28.1±2.1 23-32 28(27-29.75)	Paired t test = 57.9 p =≤0.001
Pain score			
Mean ± SD Min- max Median (IQ)	44.3±3.4 36-50 44(43-47)	15.9±1.76 12-20 16(15-17)	Paired t test = 42.2 p =≤0.001
Function score			
Mean ± SD Min- max Median (IQ)	32±42.8 26-39 32(30-34)	12.1±1.26 9-14 12(11-13)	Wilcoxon = 4.95 p =≤0.001

There was a notable improvement in total, pain and functional score (Fig. 4) (Table 4). Time of sutures removal was 10.2±3.01 SD days after surgery, without healing problems or hypertrophic scars. Two cases had delayed healing with infection for more than 2 weeks which eventually healed within 3 weeks. That was because of the poor care of the wound by the patient. Iatrogenic injuries to the nerves, vessels, or tendons were not found. The patients had no reported recurrence of the symptoms that needed reoperation. No other significant complications were found.

Table 4: pre and Postoperative Symptom severity scale of the recruited participants (no=32)

Item	Preoperative	Postoperative	Wilcoxon test and p- value
How severe is the hand or wrist pain at night			
Mean ± SD	4.06±0.84	1.44±0.50	Wilcoxon= 4.99
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	
How often did the pain wake you during a typical night in the past 2 weeks			
Mean ± SD	3.97±0.86	1.31±0.47	Wilcoxon= 5.03
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	
Do you typically have pain or wrist during the daytime			
Mean ± SD	3.94±0.80	1.34±0.48	Wilcoxon= 5.002
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	
How often do you have pain or wrist during daytime			
Mean ± SD	3.84±0.92	1.44±0.504	Wilcoxon= 4.99
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	
How long on average does an episode of pain during daytime			
Mean ± SD	4.0±0.92	1.56±0.504	Wilcoxon= 4.984
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	
Do you have numbness (loss of sensation) in your hand?			
Mean ± SD	4.09±0.86	1.41±0.59	Wilcoxon= 4.987
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	
Do you have weakness in your hand or wrist?			
Mean ± SD	4.22±0.79	1.53±0.507	Wilcoxon= 5.06
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(4-5)	2(1-2)	
Do you have tingling sensations in your hand?			
Mean ± SD	4.09±0.77	1.38±0.499	Wilcoxon= 4.982
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3.25-5)	1(1-2)	
How severe is numbness (loss of sensation) or tingling at night?			
Mean ± SD	3.88±0.79	1.53±0.507	Wilcoxon= 4.976
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-4.75)	2(1-2)	
How often did hand numbness or tingling wake you up during a typical night during the past two weeks?			
Mean ± SD	4.19±0.86	1.59±0.499	Wilcoxon= 4.984
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	2(1-2)	
Do you have difficulty with the grasping and use of small objects such as keys or pens?			
Mean ± SD	4.03±0.86	1.41±0.499	Wilcoxon= 4.990
Min- max	3-5	1-2	p =≤0.001
Median (IQ)	4(3-5)	1(1-2)	



(Fig 4): The difference between pain and functional score pre and post proximal incision of carpal tunnel release.

DISCUSSION

Treatment of carpal tunnel syndrome varies from conservative treatment to surgery. Non-surgical management combines splinting, vitamin B6 supplements, NSAIDs, and local corticosteroid injections. Surgical methods involve classical open carpal ligament release, reduced-access open release, device-assisted reduced-access procedures, and both dual- and single-port endoscopic methods [17]. Skin over the distal forearm provides an advantage since it is thin and under minimal tension compared with the thick palm skin. Distal crease incisions give superior cosmetic outcomes and prevent crossing the wrist joint. Studies involving the direct observation of wrist positioning, movement of the hands, and force exerted proved an elevated prevalence of CTS cases among specific populations [18]. Our study indicated increased prevalence of CTS among Egyptian women, probably related to housework duties characteristic for many Egyptian females. Male workers involved in heavy jobs also acquire the condition. Our patients' mean age was 48 yrs, the prime working age—a finding similar to another study [19]. CTS is an important clinical problem with specific impact upon working-age subjects. Definitive evidence confirms an occupational cause of CTS development, especially jobs involving repeated movement or handheld vibrating devices [20].

In our research, we found that the average time for the median nerve to conduct signals was 4.7±0.67 SD milliseconds. Regular electrodiagnostic (EDX) tests showed sensitivity between 45% and 56.25%. We set cutoff points at 4.4 ms for median motor distal latency and 3.5 ms for sensory latency, while most similar studies used a lower threshold of 3.7 ms for median motor latency. Research shows that electrodiagnostic testing for carpal tunnel syndrome (CTS) usually has a specificity of 90% or more, with sensitivity between 49% and 90% [21]. For milder cases of CTS, ultrasound does not find more problems than nerve conduction velocity (NCV) testing, with 23.5% of these milder cases showing no detectable issues with either method. Meta-analysis results suggest that ultrasound sensitivity for diagnosing CTS is between 87% and 94%, with specificity between 83% and 97% [21,22]. When comparing magnetic resonance imaging (MRI) to ultrasound for diagnosing CTS, studies found no significant differences in accuracy. Right now, there is no test that has perfect specificity to be a final standard for CTS electrophysiological testing [22]. Our study noted an average surgical time of about 9.6±1.8 SD minutes, while another study reported surgical times ranging from 7 to 25 minutes, with an average of 16±8 minutes from start to finish [23].

Resolution of symptoms was apparent for all cases with reduced feelings of burning, numbness, and night time increase of pain. Patients with the most classical presentation experienced the best outcomes of success. In situations where the procedure failed to provide relief, incorrect diagnosis was unveiled as the prime reason. It is crucial to understand that the procedure exclusively treats carpal tunnel syndrome and will not address symptoms for other disorders. Rates of actual recurrence of carpal tunnel syndrome after a successful outcome are uncommon; apparent recurrences usually signify an initial wrongful diagnosis of another condition [17,20].

Typically, pillar pain manifests as tenderness over the hypothenar and thenar areas. The mechanism and etiology of pillar pain remain unknown and a topic of dispute among authors. Both pillar pain and tender scarring are the most common complications following surgery for carpal tunnel syndrome. Our examination recognized postoperative pillar pain in 43.8% of the patients, slowly resolving over the period of around 4 months in all patients. Comparative studies recognized pillar pain in 48% of the patients within four weeks following surgery, diminishing over the longer term to 7% [24]. **Wong** and colleagues reported elevated pillar pain figures with endoscopic carpal tunnel surgery (53%) compared with limited-opening surgery (30%) [25]. Compared, however, **Polvsen** studied only 25% of the patients demonstrating pillar pain three months after surgery for open carpal tunnel decompression [26].

In our study, two patients had delayed healing with infections for more than two weeks, but these were readdressed within three weeks. Delayed healing was contributed to further by the fact that the patients did not take adequate care for their wounds. Complications after carpal tunnel release are rare but can include error at the time of operation, postoperative infections, pain, and recurrence or ongoing symptoms. These results are similar with other studies showing 1.2% of patients needing further surgery, 1% having recurrence or redeveloping carpal tunnel syndrome, and 0.4% having an infection or hematoma [27].

CONCLUSION

A wrist crease transverse incision approach to carpal tunnel release demonstrates clinical effectiveness, resulting in reduced discomfort and accelerated recovery without notable complications. Placing the incision at the proximal wrist crease provides superior cosmetic results due to lower skin tension and decreased likelihood of incidental contact, contributing to substantial improvement in patient symptoms.

ACKNOWLEDGMENTS

Not applicable.

Abbreviations:
CTS: Carpal tunnel syndrome.
CTR: Carpal tunnel release.

Consent for publication: Informed consent was taken from all participants who agreed to participate and publish.

Availability of data and material: The data that support the findings of the study are available from Menoufia University hospitals and can be obtained from the corresponding author.

Competing interests: No competing interests
Funding: No funds were received for this study.

REFERENCE

1. **Nordstrom D, Vierkant R, DeStefano F *et al.* (1997):** Risk factors for carpal tunnel syndrome in a general population. *Occup Environ Med.*,54(10):734–740.
2. **Franzblau A, Werner R (1999):** What is carpal tunnel syndrome? *JAMA.*,282(2):186–187.
3. **Higgs P, Edwards D, Martin D *et al.* (1995):** Carpal tunnel surgery outcomes in workers: Effect of workers' compensation status. *J Hand Surg Am.*,20(3):354–360.
4. **Steinberg D (2002):** Surgical release of the carpal tunnel. *Hand Clin.*,18(2):291–298.
5. **MacDonald R, Lichtman D, Hanlon J *et al.* (1978):** Complications of surgical release for carpal tunnel syndrome. *J Hand Surg Am.*,3(1):70–76.
6. **DaSilva M, Moore D, Weiss A *et al.* (1996):** Anatomy of the palmar cutaneous branch of the median nerve: clinical significance. *J Hand Surg Am.*,21(4):639–643.
7. **Chow J, Hantes M (2002):** Endoscopic carpal tunnel release: thirteen years' experience with the Chow technique. *J Hand Surg Am.*,27(6):1011–1018.
8. **Rowland E, Kleinert J (1994):** Endoscopic carpal tunnel release in cadavera: an investigation of the results of twelve surgeons with this training model. *J Bone Joint Surg Am.*,76(2):266–268.
9. **Cobb T, Cooney W (1994):** Significance of incomplete release of the distal portion of the flexor retinaculum: implications for endoscopic carpal tunnel surgery. *J Hand Surg Br.*,19(3):283–285.
10. **Serra J, Benito J, Monner J (1997):** Carpal tunnel release with short incision. *Plast Reconstr Surg.*,99(1):129–135.
11. **Avci S, Sayli U (2000):** Carpal tunnel release using a short palmar incision and a new knife. *J Hand Surg Br.*,25(4):357–360.
12. **Zyluk A, Strychar J (2006):** A comparison of two limited open techniques for carpal tunnel release. *J Hand Surg Br.*,31(5):466–472.
13. **Bhattacharya R, Birdsall P, Finn P *et al.* (2004):** A randomized controlled trial of knifelight and open carpal tunnel release. *J Hand Surg Br.*,29(2):113–115.
14. **Helm R, Vaziri S (2003):** Evaluation of carpal tunnel release using the Knifelight instrument. *J Hand Surg Br.*,28(3):251–254.
15. **Levine D, Simmons B, Koris M *et al.* (1993):** A self-administered questionnaire for the assessment of severity of symptoms and functional status in carpal tunnel syndrome. *J Bone Joint Surg.*,75(11):1585–1592.
16. **Masud M, Rashid M, Malik S *et al.* (2019):** Does the duration and severity of symptoms have an impact on relief of symptoms after carpal tunnel release? *J Brachial Plex Peripher Nerve Inj.*,14(1):e1–e8.
17. **Silverstein B, Fan Z, Bonauto D *et al.* (2010):** The natural course of carpal tunnel syndrome in a working population. *Scand J Work Environ Health*,36(5):384–393.
18. **Newington L, Harris E, Walker-Bone K (2015):** Carpal tunnel syndrome and work. *Best Pract Res Clin Rheumatol.*,29(3):440–453.
19. **Louie D, Earp B, Blazar P (2012):** Long-term outcomes of carpal tunnel release: a critical review of the literature. *Hand (N Y)*,7(3):242–246.
20. **Moon P, Maheshwari D, Sardana V *et al.* (2017):** Characteristics of nerve conduction studies in carpal tunnel syndrome. *Neurol India*,65(5):1013–1016.
21. **Deniz F, Oksüz E, Sarikaya B *et al.* (2012):** Comparison of the diagnostic utility of electromyography, ultrasonography, computed tomography, and magnetic resonance imaging in idiopathic carpal tunnel syndrome determined by clinical findings. *Neurosurgery.*,70(3):610–616.
22. **Yoshii Y, Zhao C, Henderson J *et al.* (2011):** Velocity-dependent changes in the relative motion of the subsynovial connective tissue in the human carpal tunnel. *J Orthop Res.*,29(1):62–66.
23. **Ludlow K, Merla J, Cox J *et al.* (1997):** Pillar pain as a postoperative complication of carpal tunnel release: a review of the literature. *J Hand Ther.*,10(4):277–282.
24. **Wong K, Hung L, Ho P *et al.* (2003):** Carpal tunnel release: a prospective, randomised study of endoscopic versus limited-open methods. *J Bone Joint Surg Br.*,85(6):863–868.
25. **Povlsen B, Tegnell I (1996):** Incidence and natural history of touch allodynia after open carpal tunnel release. *Scand J Plast Reconstr Surg Hand Surg.*,30(3):221–225.

Zhang D, Blazar P, Earp B (2019): Rates of complications and secondary surgeries of mini-open carpal tunnel release. *Hand (N Y)*,14(4):471–47.