# LONG-TERM CLINICAL EVALUATION – BY PHALEN, TINEL SIGN AND NIGHT PARESTHESIA – OF PATIENTS SUBMITTED TO CARPAL TUNNEL RELEASE SURGERY WITH PAINE® RETINACULATOME

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## SUMMARY

*The release of flexors retinaculum for carpal tunnel syndrome (CTS) treatment is one of the most frequently performed surgeries. There are many methods for performing this surgical procedure, such as endoscopic, classical open port and mini-incisions. Few papers show the long-term results of those surgeries. This study is aimed to evaluate patients submitted to carpal tunnel syndrome release using the Paine® instrument, in at least 84 months postoperatively. The following clinical parameters were assessed: Phalen test, painful percussion sign, and complaints of nighttime paresthesia pre- and postoperatively. The results show that there is a significant improvement of the signs assessed (p.....), when compared to baseline evaluation, and that those clinical signs remain negative with time.*

***Keywords:*** *Carpal tunnel syndrome; Release with Paine's retinaculotome; Phalen's test; Treatment outcome.*

## INTRODUCTION

The medial nerve is located, together with finger's superficial and deep flexor tendons and thumb's long flexor, at carpal tunnel. Medial nerve is found volarlly to flexor tendons inside the tunnel. That tunnel is bounded, on its floor, by concave arc of carpal bones and, on its roof, by flexors' retinaculum. The compression on this nerve at that region is known as carpal tunnel syndrome (CTS).

The surgical release of flexors' retinaculum is one of the most commonly performed procedures worldwide, because CTS is the most prevalent compressive syndrome. This syndrome is characterized by paresthesia and burning sensation, especially at night, improving with movements, in middle-age women. Compression may occur as a result of a space reduction inside the tunnel or of the enlargement of structures inside it. The narrowest region is located at hamate hamulus level and wrist flexion causes nerve compression by flexors' retinaculum proximal margin [1].

Carpal tunnel decompression can be performed in many ways, each method presenting its outcomes and complications [2,3,4,5,6,7]. Recently, interest in endoscopic methods has increased, since these abbreviate patients' return to their daily activities [8]. However, this method requires a vast experienced surgeon, as well as highly costly surgical material, sometimes unfeasible to our patients' reality. It also presents many complications [9].

This study has as objective to reassess 112 hands submitted to surgical treatment with the Paine® retinaculatome regarding the evolution of clinical parameters, Phalen's test, painful percussion sign, and nighttime paresthesia complaints.

## MATERIALS AND METHODS

Eighty nine patients (112 hands) operated with the Paine® retinaculatome[10] within a period of three years (March 1995 - March 1998) were called for reassessment, but 45 patients (57 hands) were effectively reassessed. The other 44 patients did not show, and were excluded from the study. Patients whose records did not present the results of previous routine assessments (preoperative, two weeks, one, three and six months postoperatively) were also excluded. For final analysis of data, 29 patients remained, totaling 39 hands (11 bilateral cases). General data for all reassessed patients [age, gender, involved hand(s), dominant hand, and operated hand(s)] chronologically sorted by procedure date are listed on Table 1. Due to bilateral syndrome and surgeries, eleven patients (2 and 5, 3 and 4, 6 and 11, 7 and 15, 8 and 13, 16 and 33, 18 and 19, 25 and 28, 26 and 27, 29 and 31, 37 and 39) are reported twice, once for each operation.

No hand had been submitted to more than one surgical procedure. Time elapsed from last postoperative assessment ranged from 84 to 116 months, with an average of 97.6 months. Patients' age at the time of surgery was between 31 and 68 years old, with an average of 48.3 years. At last reassessment, ages ranged from 38 to 77 years, with an average of 56.5 years.

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| Order | Age | Gender | Involvd. Hand | Dom. Hand | Oper. Hand |
|---|---|---|---|---|---|
| 1 | 68 | F | Bilat | Left | Left |
| 2 | 37 | F | Bilat | Right | Right |
| 3 | 45 | F | Bilat | Right | Right |
| 4 | 45 | F | Bilat | Right | Left |
| 5 | 37 | F | Bilat | Right | Left |
| 6 | 37 | F | Bilat | Right | Right |
| 7 | 38 | F | Bilat | Right | Left |
| 8 | 39 | F | Bilat | Right | Left |
| 9 | 52 | F | Bilat | Right | Right |
| 10 | 48 | F | Bilat | Right | Right |
| 11 | 37 | F | Bilat | Right | Left |
| 12 | 49 | F | Bilat | Right | Right |
| 13 | 39 | F | Bilat | Right | Right |
| 14 | 38 | F | Right | Right | Right |
| 15 | 38 | F | Bilat | Right | Right |
| 16 | 41 | F | Bilat | Right | Left |
| 17 | 40 | F | Bilat | Right | Left |
| 18 | 56 | F | Bilat | Right | Left |
| 19 | 56 | F | Bilat | Right | Right |
| 20 | 52 | F | Bilat | Right | Right |
| 21 | 60 | F | Right | Right | Right |
| 22 | 62 | F | Bilat | Right | Right |
| 23 | 50 | F | Bilat | Right | Right |
| 24 | 51 | F | Bilat | Right | Right |
| 25 | 55 | F | Bilat | Right | Right |
| 26 | 50 | F | Bilat | Right | Right |
| 27 | 50 | F | Bilat | Right | Left |
| 28 | 55 | F | Bilat | Right | Left |
| 29 | 50 | F | Bilat | Both | Right |
| 30 | 61 | F | Bilat | Both | Right |
| 31 | 50 | F | Bilat | Both | Left |
| 32 | 58 | F | Bilat | Right | Left |
| 33 | 41 | F | Bilat | Right | Right |
| 34 | 62 | M | Right | Right | Right |
| 35 | 53 | F | Right | Right | Right |
| 36 | 31 | F | Right | Right | Right |
| 37 | 40 | F | Bilat | Right | Right |
| 38 | 38 | F | Bilat | Right | Right |
| 39 | 40 | F | Bilat | Right | Left |

***Table 1 -*** *Patients' characteristics*

| Order | Pre-Op | 02 Weeks | 01 month | 3rd month | 6th month | Current |
|---|---|---|---|---|---|---|
| 1 | posit | negat | negat | negat | negat | negat |
| 2 | posit | negat | negat | negat | negat | negat |
| 3 | posit | negat | negat | negat | negat | negat |
| 4 | posit | negat | negat | negat | negat | negat |
| 5 | posit | negat | negat | negat | negat | negat |
| 6 | posit | negat | negat | posit | posit | negat |
| 7 | posit | negat | negat | negat | negat | negat |
| 8 | posit | negat | negat | negat | negat | negat |
| 9 | posit | negat | negat | negat | negat | negat |
| 10 | posit | negat | negat | negat | negat | negat |
| 11 | posit | negat | negat | negat | negat | posit |
| 12 | posit | negat | negat | negat | negat | negat |
| 13 | posit | negat | negat | negat | nega | negat |
| 14 | posit | negat | negat | negat | negat | negat |
| 15 | posit | negat | negat | negat | negat | negat |
| 16 | posit | negat | negat | negat | negat | negat |
| 17 | posit | negat | negat | negat | negat | negat |
| 18 | posit | negat | negat | negat | negat | negat |
| 19 | posit | negat | negat | negat | negat | negat |
| 20 | posit | negat | negat | negat | negat | negat |
| 21 | posit | negat | negat | negat | negat | negat |
| 22 | posit | negat | negat | negat | negat | negat |
| 23 | posit | negat | negat | negat | negat | negat |
| 24 | posit | negat | negat | negat | negat | posit |
| 25 | posit | negat | negat | negat | negat | negat |
| 26 | posit | negat | negat | negat | negat | posit |
| 27 | posit | negat | negat | negat | negat | posit |
| 28 | posit | negat | negat | negat | negat | negat |
| 29 | posit | negat | negat | negat | negat | negat |
| 30 | posit | negat | negat | negat | negat | negat |
| 31 | posit | negat | negat | negat | negat | negat |
| 32 | posit | negat | negat | negat | negat | negat |
| 33 | posit | negat | negat | negat | negat | negat |
| 34 | posit | negat | negat | negat | negat | negat |
| 35 | posit | negat | negat | negat | negat | negat |
| 36 | posit | negat | negat | negat | negat | negat |
| 37 | posit | negat | negat | negat | negat | negat |
| 38 | posit | negat | negat | negat | negat | negat |
| 39 | posit | negat | negat | negat | negat | negat |

***Table 2 -*** *Pre- and postoperative evaluation of nighttime paresthesia*

Regarding gender, 38 (97.4%) were females and one (2.6%) male.

Regarding the involved hand, 34 (87.2%) were bilateral, five (12.8%) were right hands and 0 (0%) was left hand. Thirty five (89.7%) patients were right-handed, one (2.6%) had a left dominant hand, and three (7.7%) had both dominant hands. Carpal tunnel decompression was performed in 25 (64.1%) right hands and 14 (35.9%) left hands; from these, 11 were bilateral.

Table 2 shows the evaluations at the following time points: preoperative, 2 weeks, 1 month, 3 months, 6 months postoperatively, and current reassessment of nighttime paresthesia, according to chronological order of surgeries. Table 3 shows data regarding evaluations of Phalen's test at the same pre- and postoperative time points previously mentioned and with the same chronological order. Table 4 shows evaluations preoperatively, and 2 weeks, 1 month, 3 months, 6 months postoperatively, and current reassessment of painful percussion sign, according to chronological order of surgeries.

Nighttime paresthesia was assessed by means of patients' subjective complaint.

Phalen's test was considered positive when paresthesia or "tingling" sensation on innervated topography by median nerve, at the moment in which the patient remained with flexed wrists for 30 - 60 seconds [7,11].

The painful percussion sign was evaluated by percussing the region corresponding to median nerve at the wrist. This sign was considered as positive when a patient presented pain or shock at the area innervated by median nerve.

## STATISTICAL METHOD

For evaluating pre- and postoperative evolution for variables addressed (nighttime paresthesia, Phalen's sign and Tinel's sign), we used the McNemar's test.

Values equal or lower than 0.05%, were considered as

| Order | Pre-Op | 02 Weeks | 1st month | 3rd month | 6th month | Current |
|---|---|---|---|---|---|---|
| 1 | posit | negat | negat | negat | negat | negat |
| 2 | posit | negat | negat | negat | negat | negat |
| 3 | posit | negat | negat | negat | negat | negat |
| 4 | posit | negat | negat | negat | negat | negat |
| 5 | posit | negat | negat | negat | negat | negat |
| 6 | posit | negat | negat | negat | negat | negat |
| 7 | posit | negat | negat | negat | negat | negat |
| 8 | posit | negat | negat | negat | negat | negat |
| 9 | posit | negat | negat | negat | negat | negat |
| 10 | posit | negat | negat | negat | negat | negat |
| 11 | posit | negat | negat | negat | negat | negat |
| 12 | negat | negat | negat | negat | negat | negat |
| 13 | posit | negat | negat | negat | negat | negat |
| 14 | posit | negat | negat | negat | negat | negat |
| 15 | posit | negat | negat | negat | negat | negat |
| 16 | posit | negat | negat | negat | negat | negat |
| 17 | posit | negat | negat | negat | negat | negat |
| 18 | posit | negat | negat | negat | negat | negat |
| 19 | posit | negat | negat | negat | negat | negat |
| 20 | posit | negat | negat | negat | negat | negat |
| 21 | posit | negat | negat | negat | negat | negat |
| 22 | posit | negat | negat | negat | negat | negat |
| 23 | negat | negat | negat | negat | negat | negat |
| 24 | posit | negat | negat | negat | posit | negat |
| 25 | posit | negat | negat | negat | negat | negat |
| 26 | posit | negat | negat | negat | negat | posit |
| 27 | posit | posit | negat | negat | negat | posit |
| 28 | posit | posit | negat | negat | negat | negat |
| 29 | posit | negat | negat | negat | negat | negat |
| 30 | negat | negat | negat | negat | negat | negat |
| 31 | posit | negat | negat | negat | negat | negat |
| 32 | posit | negat | negat | negat | negat | posit |
| 33 | negat | negat | negat | negat | negat | negat |
| 34 | posit | negat | negat | negat | negat | negat |
| 35 | posit | negat | negat | negat | negat | negat |
| 36 | posit | negat | negat | negat | negat | negat |
| 37 | posit | negat | negat | negat | negat | negat |
| 38 | posit | negat | negat | negat | negat | negat |
| 39 | posit | negat | negat | negat | negat | negat |

***Table 3 -*** *Pre- and postoperative evaluation of Phalen's sign.*

| Order | Pre-Op | 02 Weeks | 1st month | 3rd month | 6th month | Current |
|---|---|---|---|---|---|---|
| 1 | posit | negat | negat | negat | negat | negat |
| 2 | negat | negat | negat | negat | negat | negat |
| 3 | posit | negat | negat | negat | negat | negat |
| 4 | posit | negat | negat | negat | negat | negat |
| 5 | negat | negat | negat | negat | negat | negat |
| 6 | posit | negat | negat | negat | negat | negat |
| 7 | posit | negat | negat | negat | negat | negat |
| 8 | posit | negat | negat | negat | negat | negat |
| 9 | posit | negat | negat | negat | negat | negat |
| 10 | posit | negat | negat | negat | negat | negat |
| 11 | posit | negat | negat | negat | negat | negat |
| 12 | posit | negat | negat | negat | negat | negat |
| 13 | posit | negat | negat | negat | negat | negat |
| 14 | posit | negat | negat | negat | negat | negat |
| 15 | negat | negat | negat | negat | negat | negat |
| 16 | negat | negat | negat | negat | negat | negat |
| 17 | posit | posit | posit | negat | negat | negat |
| 18 | negat | negat | negat | negat | negat | negat |
| 19 | negat | negat | negat | negat | negat | negat |
| 20 | negat | negat | negat | negat | negat | negat |
| 21 | posit | negat | negat | negat | negat | negat |
| 22 | posit | negat | negat | negat | negat | negat |
| 23 | negat | negat | negat | negat | negat | negat |
| 24 | posit | posit | negat | posit | negat | negat |
| 25 | posit | negat | negat | negat | negat | negat |
| 26 | posit | negat | negat | negat | negat | posit |
| 27 | posit | negat | negat | negat | negat | posit |
| 28 | posit | negat | negat | negat | negat | negat |
| 29 | negat | negat | negat | negat | negat | negat |
| 30 | negat | negat | negat | negat | negat | negat |
| 31 | posit | posit | negat | negat | posit | negat |
| 32 | posit | negat | negat | negat | negat | negat |
| 33 | negat | negat | negat | negat | negat | negat |
| 34 | posit | negat | negat | negat | negat | negat |
| 35 | negat | negat | negat | negat | negat | negat |
| 36 | posit | negat | negat | negat | negat | negat |
| 37 | posit | negat | negat | negat | negat | negat |
| 38 | posit | negat | negat | negat | negat | negat |
| 39 | posit | negat | negat | negat | negat | negat |

***Table 4 -*** *Pre- and postoperative evaluation of Tinel's sign.*

statistically significant, which were marked on the text with an asterisk (*). Where no statistical difference existed, the abbreviation NS was used.

## RESULTS

Charts 1 to 6 show results regarding each sign and comparisons between preoperative period and current reassessment, and a comparison between 6 months postoperatively and current reassessment. The statistical analysis is shown just below each chart, with or without its statistical value.

## DISCUSSION

Few articles in literature report a long-term follow-up of patients submitted to surgical treatment of CTS [12, 13,14].

Regarding gender, our case series is consistent to literature, with female group being most affected. We found 97.4% in our study, this value being close to the ones reported in literature (88 - 90%)[15,16]. Bilateral incidence, in this study, was the most frequent (87.2%), followed by right hand alone (12.8%). There was no case of left hand involvement. These data are similar to those found in other articles[17].

Surgery was predominantly performed on right limb (64.1%), with this value being variable in literature[13,16].

For providing a clinical diagnosis, we probed the nighttime paresthesia, Phalen's test and the painful percussion sign (Tinel's sign). The effectiveness of those tests was proved by many authors[18,19,20], reaching a rate of 88% for diagnostic assurance[20], with nighttime paresthesia being the most important indicative factor since all patients submitted to carpal tunnel release presented with that symptom preoperatively. Regarding nighttime paresthesia, an early improvement was seen in patients, since within 2 weeks postoperatively all patients no longer had that symptom. Only one patient (2.6%) came back 3 months later complaining about that

| parpr | par current | |
|---|---|---|
| | Neg | Pos |
| Neg | 0 | 0 |
| Pos | 35 | 4 |
| Total | 35 | 4 |

P=0,000...*

***Chart 1 -*** *Comparison of preoperative nighttime paresthesia (parpr) and current postoperative assessment (par current).*

| par6m | par current | |
|---|---|---|
| | Neg | Pos |
| Neg | 34 | 4 |
| Pos | 1 | 0 |
| Total | 35 | 4 |

P=0,375 (NS)

***Chart 2 -*** *Comparison of nighttime paresthesia 6 months postoperatively (par6m) and current postoperative assessment (par current).*

| pre ph | current ph | |
|---|---|---|
| | Neg | Pos |
| Neg | 4 | 0 |
| Pos | 32 | 3 |
| Total | 36 | 3 |

P=0,000...*

***Chart 3 -*** *Comparison of Phalen's sign preoperatively (pre ph)and current postoperative assessment (current ph).*

| ph 6m | current ph | |
|---|---|---|
| | Neg | Pos |
| Neg | 35 | 3 |
| Pos | 1 | 0 |
| Total | 36 | 3 |

P= 0,625 (NS)

***Chart 4 -*** *Comparison of Phalen's sign 6 months postoperatively (ph 6m) and current postoperative assessment (current ph).*

| tipr | ti current | |
|---|---|---|
| | Neg | Pos |
| Neg | 12 | 0 |
| Pos | 25 | 2 |
| Total | 37 | 2 |

P= 0,000...*

***Chart 5 -*** *Comparison of preoperative Tinel's sign (tipr) and current postoperative assessment (ti current).*

| ti 6m | ti current | |
|---|---|---|
| | Neg | Pos |
| Neg | 36 | 2 |
| Pos | 1 | 0 |
| Total | 37 | 2 |

P= 1,00 (NS)

***Chart 6 -*** *Comparison of Tinel's sign 6 months postoperatively (ti 6m) and current postoperative assessment (ti current).*

symptom. Thirty five patients (89.7%) currently remain free of that sign, not showing any statistically significant difference when compared to the group with 6 months of surgery.

The evaluation of Phalen's test is possible due to the existence of compression intensification on median nerve with wrist flexion. This sign disappeared after 1 month postoperatively for all patients. This test showed recurrence in one patient (2.6%) at 6 months. Today, 36 patients (92.3%) remain negative to Phalen's test, with no statistical difference between those last two groups.

The Tinel's sign, as described by this author, consists of a gentle percussion throughout a nervous stem in order to follow up a nerve's axonal regeneration. Percussion must be made from distal to proximal. At the site corresponding to regeneration, a shock sensation is felt with distal irradiation to the distribution area of the examined nerve. That sensation occurs in a nerve submitted to compression, being wrongly called Tinel's sign [11].

Painful percussion remained always present at least in one patient. However, there was a reduction of this sign when compared to baseline evaluation. At the last reassessment, two patients (5.5%) presented with a positive test, and 94.5% were negative, showing no statistical difference between 6 months postoperatively and the current evaluation. New clinical evaluation methods have not been adopted because those were not validated up to the time of surgery [19].

## CONCLUSION

We noticed that, with time, a statistically significant improvement of assessed clinical signs occurs. We also observed that, over time, there is no recurrence of assessed clinical signs. Thus, the Paine® instrument is a quite useful method for clinical outcomes.

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