

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

SERGIO EITI CARBONE DE PAULA¹, LUCIANA LEONEL DOS SANTOS¹, LIA MIYAMOTO MEIRELLES², JOÃO BAPTISTA GOMES DOS SANTOS³, FLÁVIO FALOPPA⁴, WALTER MANNA ALBERTONI⁵, CARLOS HENRIQUE FERNANDES⁶

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 ($p < 0.05$), 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 volarly 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® retinaculotome 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® retinaculotome⁽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.

Study conducted by the Discipline of Hand and Upper Limb Surgery, Department of Orthopaedics and Traumatology, Federal University of São Paulo – DOT/UNIFESP.

Correspondences to: Rua Imaculada Conceição, 108 apto 24 – CEP 01226-020 – Santa Cecília – São Paulo – SP. E-mail: sergioeiti@hotmail.com

1 - Resident Doctor, Department of Orthopaedics and Traumatology.

2 - Physical therapist, expert in Hand Therapy.

3 - PhD in Sciences; Head of the Discipline of Hand and Upper Limb Surgery, Department of Orthopaedics and Traumatology.

4 - Chairman, Head of the Department of Orthopaedics and Traumatology.

5 - Chairman, Department of Orthopaedics and Traumatology.

6 - PhD in Sciences, Doctor, Discipline of Hand and Upper Limb Surgery, Department of Orthopaedics and Traumatology.

Received in: 03/31/06; approved in: 05/31/06

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

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 percus-

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

sion 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.

REFERENCES

- Tanzer, RC- The carpal-tunnel syndrome: a clinical and anatomical study. J Bone Joint Surg. 1959;41A:626-34.
- Gerritsen AA, Uidehaag BM, van Geldere D, Scholten RJ, de Vet HC, Bouter LM. Systematic review of randomized clinical trials of surgical treatment for carpal tunnel syndrome. Br J Surg. 2001;88:1285-95.
- Scholten RJ, Gerritsen AA, Uidehaag BM, van Geldere D, de Vet HC, Bouter LM. Surgical treatment options for carpal tunnel syndrome. Cochrane database Syst Rev.: CD003905, 2004.
- Thoma A, Veltri K, Haines T, Duku E. A systematic review of reviews comparing the effectiveness of endoscopic and open carpal tunnel decompression. Plast Reconstr Surg. 2004;113:1184-91.
- Zumiotti AV, Ohno PE, Prada FS, Azze RJ. Complicações do tratamento cirúrgico da síndrome do túnel do carpo. Rev Bras Ortop. 1996;31:199-202.
- Gerritsen AA, de Vet HC, Scholten RJ, Bertelsmann FW, de Krom MC, Bouter LM. Splinting vs surgery in the treatment of carpal tunnel syndrome: a randomized controlled trial. JAMA. 2002;88:1245-51.
- Phalen GS. The carpal-tunnel syndrome. Seventeen years' experience in diagnosis and treatment of six hundred fifty-four hands. J Bone Joint Surg Am. 1966;48:211-28.
- Zumiotti AV, Ohno PE. Tratamento cirúrgico da síndrome do túnel do carpo via endoscópica. Rev Bras Ortop. 1994;29:561-4.
- Macdermid JC, Richards RS, Roth JH, Ross DC, King GJ. Endoscopic versus open carpal tunnel release: a randomized trial. J Hand Surg Am. 2003;28:475-80.
- Fernandes CH, Meirelles LM, Carneiro RS, Faloppa F, Albertoni WM. Tratamento cirúrgico da síndrome do canal do carpo por incisão palmar e utilização do instrumento de Paine®. Rev Bras Ortop. 1999; 34:260-70.
- Pardini Junior AG. Punho. In: Barros Filho TEP, Lech B. Exame físico em ortopedia. 2 ed. São Paulo: Sarvier; 2001. p.157-70.
- Haupt WF, Wintzer G, Schop A, Lottgen J, Pawlik G. Long-term results of carpal tunnel decompression. Assessment of 60 cases. J Hand Surg Br. 1993; 18:471-4.
- Nancollas MP, Peimer CA, Wheeler DR, Sherwin FS. Long-term results of carpal tunnel release. J Hand Surg Br. 1995;20:470-4.
- Santos LL, Branco MA, Meirelles LM, Santos JBG, Faloppa F, Alneroni WM et al. Reavaliação a longo prazo do tratamento cirúrgico da síndrome do túnel do carpo por incisão palmar e utilização do instrumento de Paine®. Acta Ortop Bras. 2005; 13: 225-8.
- Segre NG. Avaliação pós-operatória do tratamento da síndrome do túnel do carpo pela via de acesso ulnar [dissertação]. São Paulo: Universidade Federal de São Paulo; 1996.
- Cortez M, Costi LE, Machado GS, Ribeiro FGL, Silva PFS. Liberação endoscópica do túnel do carpo pela técnica de Agee com instrumental modificado. Rev Bras Ortop. 1997; 32:75-8.
- Paine KWE, Polyzoidis KS. Carpal tunnel syndrome: decompression using the paine retinaculotome. J Neurosurg. 1983; 59:1031-6.
- Golding DN, Rose DM, Selvarajah, K. Clinical tests for carpal tunnel syndrome: an evaluation. Br J Rheum. 1986; 25:388-90.
- Ahn DS. Hand elevation: a new test for carpal tunnel syndrome. Ann Plast Surg. 2001; 46:120-4.
- Amo C, Fernandez-Gil S, Perez-Fernandez S, Amo-Merino P, Amo-Usanos I, Franco C et al. Carpal tunnel syndrome: clinical and neurophysiological correlation: review of 100 cases. Rev Neurol. 1998; 27: 490-3.