

# THE USEFULNESS OF THE PHALEN TEST AND THE HOFFMANN-TINEL SIGN IN THE DIAGNOSIS OF CARPAL TUNNEL SYNDROME

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Both the Phalen test and the percussion (Hoffmann-Tinel) test are considered to be the classic diagnostic tests for Carpal Tunnel Syndrome (CTS). Sensitivity of these tests, as given in the literature, ranges from 42 to 85% (Phalen) and from 38 to 100% (Hoffmann-Tinel), and specificity from 54 to 98% and from 55 to 100% respectively. The objective of this study was to evaluate sensitivity and specificity of both tests and to analyse the influence of such selected factors, such as patient's age and duration of symptoms. The clinical group consisted of 112 patients (147 hands) with CTS confirmed clinically and on nerve conduction studies. The control group of 50 patients (100 hands) was selected from hospital volunteers, who did not complain of any hand symptoms. Sensitivity and specificity of the Phalen test turned out to be respectively 85 and 89% and for the percussion test, 67 and 68%. There was no significant influence of patients' age upon the test results. Seventeen patients showed negative results for both tests, but in these individuals, the duration of symptoms was significantly longer than in the remaining group. These findings indicated essential diagnostic value for the Phalen test, but considerably smaller for the percussion test. In the diagnosis of long lasting syndromes, the usefulness of both tests is limited.

**Keywords** : carpal tunnel syndrome ; Phalen test ; Hoffmann-Tinel sign.

**Mots-clés** : syndrome du tunnel carpien ; test de Phalen ; signe de Hoffmann-Tinel.

cal examination. Clinical signs consist of pain, paresthesia (numbness and tingling) and hyposthesia of three and a half radial digits, as well as a decrease in grip strength and hand clumsiness. These complaints get worse at night and upon exertion. Provocative tests, such as the most commonly used wrist flexion test (Phalen test) and percussion test, which utilises the Hoffman-Tinel sign (3, 14) are also widely used. Both tests consist of an evocation or intensification of the symptoms by maintaining the wrist in flexion (Phalen position) and percussion over the transverse carpal ligament, thus causing paresthesias along the distribution of the median nerve.

The clinical usefulness of these tests varies and their sensitivity ranges from 42 to 91% for the Phalen test (1, 2, 4, 5, 6, 8, 10, 13-16, 18) and from 38 to 100% for the Hoffmann-Tinel sign (1, 2, 4, 5, 6, 8, 10-17, 20). Their specificity is reported from 54 to 98% for the Phalen test (2, 4, 6, 8, 10, 15, 18) and from 55 to 100% for the Hoffmann-Tinel sign (2, 4, 6, 8, 10, 15, 17, 20). No information is available in the literature as to other factors influencing positive or negative outcomes of these tests.

Nerve conduction studies are considered to be the most precise and objective tests for the diagnosis of CTS. Their sensitivity ranges from 61 to 85% and specificity from 87 to 92% (1, 2, 13). Some

## INTRODUCTION

The diagnosis of carpal tunnel syndrome (CTS) is based mainly on clinical and electrophysiologi-

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authors, however, believe that the assessment of median nerve conductivity is superfluous, given the obvious clinical picture. Others recommend this examination in all cases before the decision to operate is made (2, 13).

The objective of this study was to evaluate the sensitivity and specificity of the Phalen test and the Hoffmann-Tinel sign in the diagnosis of CTS and to analyse how such factors as patient's age and duration of symptoms influence these parameters. The tests were performed as a prospective and controlled clinical analysis.

### MATERIAL AND METHODS

The study group consisted of 112 patients (total of 147 hands) with CTS, treated surgically in 1993-98. There were 89 women (80%) and 23 men (20%) aged from 21 to 82 years (mean 53 years). Patients with post-traumatic CTS and coexisting systemic diseases were excluded. The control group consisted of 100 hands from among 50 hospital employees and nursing school students, 36 women (72%) and 14 men (28%) between 18 and 65 years of age (mean 36 years) who did not complain of any hand symptoms and had not suffered any hand injury.

In the study group, the diagnosis of CTS was confirmed by clinical examination and nerve conduction studies. All patients with CTS had nerve conduction studies performed in the Electrophysiology Laboratory in the Department of Neurology of the Pomeranian Medical Academy, carried out on the Keypoint machine (Medtronic, USA). The results showed signs of median nerve compression at the wrist level, decreased sensory conduction velocity below 40 m/s and standard distal motor latency more than 0.60 ms/cm.

The Phalen test was done in both groups, following Phalen's original description (14). The test was considered positive if a patient complained of paresthesias in at least one of the three radial digits within 60 seconds of the onset of the examination. The percussion test (Hoffmann-Tinel) encompassed threefold percussion of the palmar ligament region with a neurological hammer (with a mean force of hammer strike of 0.24 kg), while maintaining the wrist in a neutral position. The test was positive if there were paresthesias in at least one of the three radial digits of the examined hand, in at least one of the three trials. Sensitivity and specificity were assessed based on widely used principles. Statistical analysis was done using Student's t-test.

### RESULTS

Table I shows the number of positive and negative results of the Phalen test and the percussion (Hoffmann-Tinel) test in the CTS group as well as in the control group. Sensitivity and specificity for the Phalen test were respectively 85 and 89% and for the percussion test 67 and 68%. Table II illustrates an analysis of the influence of selected factors - duration of symptoms and patients' age. There was no statistical influence of patients' age on the results (Student's t-test,  $p > 0.5$ ). The duration of symptoms did not differ significantly in the subgroups with a positive result in one or the other test, nor in those patients with both tests positive. However, both tests turned out negative in 17 patients, with the duration of symptoms significantly longer than in the remaining groups, i.e. 13 years on average (Student's t-test,  $p > 0.01$ ). The complaints among the patients in this group were of a more permanent character.

### DISCUSSION

The reasons behind large differences in the results of sensitivity and specificity of the assessed provocative tests in patients with CTS are explained by the non-homogenous character of the examined groups of patients, different degrees in progression of the syndrome, as well as various

Table I. — Numbers of positive and negative results in Phalen test and percussion test in CTS and control groups

	Phalen test			
	Positive	Negative	Sensitivity	Specificity
CTS group (147 hands)	125	22	85%	—
Control group (100 hands)	11	89	—	89%
	Percussion test			
	Positive	Negative	Sensitivity	Specificity
CTS group (147 hands)	99	48	67%	—
Control group (100 hands)	32	68	—	68%

Table II. — Influence of the duration of symptoms and patients' age on test results

Result of the test	Subgroups				Total
	+	+	+	–	
Phalen test	+	+	–	–	
Percussion test	+	–	+	–	
Number of hands	94	31	5	17	147
Duration of symptoms (years)	0.5-20	0.5-15	1.5-3	3-25*	0.5-25
Mean	4.6	4.1	2.1	13.3*	5.4
Age of patient (years)	21-82	40-77	38-63	47-76	21-82
Mean	52	52	49	59	53

\* Statistically significant.

influencing factors. In most publications, the authors did not determine a cause for the syndrome (idiopathic CTS) (1, 2, 6-13, 20). Rietz and Örne diagnosed traumatic CTS in 45% (16). Minami and Ogino had all their patients with long standing haemodialysis (11).

Methods of performing these tests also seem to play a significant role, especially the percussion test. Some use their fingertips, while others perform it with a neurological hammer. Mossman and Blau obtained a positive Hoffmann-Tinel sign in 49% using their fingertips, while generating up to 79% positive signs with a hammer in the same group of patients (12). The Phalen test requires flexion of the wrist and causes compression of the nerve under the palmar ligament. Magnetic resonance imaging studies showed the smallest volume of carpal canal in wrist flexion and nerve compression underneath the transverse carpal ligament (19). Gelberman *et al.* demonstrated significantly increased pressure in the carpal tunnel in flexed wrists, such as the position in flexion leads to nerve ischaemia which in turn provokes CTS signs (7). The Phalen test is therefore a classic provocative test, as opposed to the percussion test, which merely displays hypersensitivity of diseased and regenerating nerve.

According to Tinel, the significance of the positive sign depends on evoking a mechanical wave that irritates regenerating nerve fibres. This, according to Hoffmann, triggers sensations of paresthesias in the median nerve distribution (3, 9). Evocation of a sign depends on strike force, mechanical susceptibility of tissue and nerve fibre

responsiveness. Severely damaged nerve regenerates poorly and the Hoffman-Tinel sign may not appear, even after intensive percussion. On the other hand, a healthy nerve may react with paresthesias after intensive percussion. The sensitivity of a percussion test, as mentioned in literature, ranges from 38 to 100% and depends on a variety of influencing factors.

Considering this, Durkan (6) and Richter and Brüser (15) proposed modified provocative tests with standardised pressure force, which resulted in increased sensitivity up to 87% and specificity up to 90% (6) and 96% (15). De Smet *et al.* found a sensitivity of 62% for Phalen's test versus 42% for the Tinel sign (4). Gellman *et al.* (8) in their studies achieved 44% sensitivity and 94% specificity, Steward and Eisen (20) 45% sensitivity and 71% specificity, Durkan (6) 56% and 80%, Seror (17) 63% and 55% and Gelmers (9) 43% and 77%. Based on these studies, one can conclude that the percussion test is characterized by low sensitivity and at the same time, relatively high specificity. In our study, the sensitivity approached 67% and specificity 68% and conformed to the conclusions of Kushner *et al.* (10) as well as to those of Seror (7). On the other hand, our high sensitivity and specificity for the Phalen test is similar to the results from other authors (6, 8, 10, 15).

Analysis of selected factors, such as duration of symptoms and age, did not reveal significant influence of age on the results (table II). An interesting finding was made studying the influence of the duration of symptoms. There was a negative result in both tests in 17 patients in which the duration of

symptoms was significantly longer than in the remaining groups. This can be explained by the progressive atrophy of nerve fibres and their lack of a response to the provocative stimuli. Dudley Porras *et al.* drew similar conclusions, as they observed negative results for both tests only in patients with symptoms lasting for more than 10 years (5).

These findings indicate that the Phalen test is useful in the diagnosis of CTS, and its diagnostic value approaches that of the nerve conduction studies. However, the diagnostic value of a percussion test is clearly smaller. For long lasting syndromes (more than 10 years), both tests are useless.

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## SAMENVATTING

*J. BRÜSKE, M. BEDNARSKI, H. GRZELEC, A. ZYLUK. Resultaten van de heelkundige behandeling van fracturen van de basis van de eerste metacarpaal.*

De resultaten worden beschreven van de heelkundige behandeling van intra-articulaire fracturen van de basis van metacarpaal één bij 21 patiënten. In 14 gevallen werd de gesloten reductie gevolgd van een enkelvoudige of dubbele kirchnerpinning vanuit de diaphyse van metacarpaal I naar het multangulum majus. In 5 laat-tijdige gevallen kon gesloten reductie niet worden bekomen, en moest ze heelkundig worden bereikt, waarna tevens pinning. Telkens werden postoperatief de hand en de pols gedurende 4 weken geïmmobiliseerd. Twee patiënten vertoonden een Rolando fractuur : hier werd na gesloten reductie, uitwendige fixatie verkozen. De follow-up periode bedroeg gemiddeld 1.5 jaar (van 6 maand tot 3 jaar). Telkens werd consolidatie bereikt. Bij de finale evaluatie vermelden 14 patiënten de afwezigheid van pijn, 2 hadden lichte hinder bij inspanning en 5 hadden "weer" pijn. De grijpkracht lag tussen 72% en 85% (gemiddeld 80%) van de normale waarde, rekening houdend met geslacht, ouderdom, en dominante zijde. Bij allen was de oppositie van de duim volledig hersteld. De handfunctie gemeten volgens een

analoge, visuele schaal behaalde gemiddeld 1.2 (gaande van 1.1 tot 1.5), waarbij schaal 1 staat voor normale handfunctie en schaal 5 voor volledige machteloosheid. De radiologische duimabductie ging tot 30° à 50°, dit is 5° tot 12° min dan de gezonde zijde. Zestien patiënten hadden een lichte zadelgewrichtsvernauwing. Allen hernamen hun normaal werk, wat zware manuele arbeid betekende voor 5. Geen enkel had problemen bij de activiteiten van het dagelijkse leven. De resultaten suggereren dat acute Bennett fracturen wel degelijk kunnen worden behandeld met gesloten reductie en percutane pinning. Laattijdig behandelde fracturen vragen open reductie.

### RÉSUMÉ

*J. BRÜSKE, M. BEDNARSKI, H. GRZELEC, A. ZYLUK.  
Intérêt du test de Phalen et du signe de Hoffmann-Tinel dans le diagnostic du syndrome du tunnel carpien.*

Le test de Phalen, comme le signe de Hoffmann-Tinel sont considérés comme des tests classiques dans le diagnostic du syndrome du tunnel carpien. Dans la littérature, leur sensibilité varie de 42 à 85% pour le test de

Phalen, et de 38 à 100% pour le test de Hoffmann-Tinel ; leur spécificité varie de 54 à 98% pour le premier, de 55 à 100% pour le second. Ce travail avait pour objet d'évaluer la sensibilité et la spécificité des deux tests et d'analyser l'influence de certains facteurs tel que l'âge des patients et la durée des symptômes. Le groupe étudié comportait 112 patients (147 mains), présentant un syndrome du tunnel carpien confirmé par la clinique et sur base d'une étude de la conduction nerveuse. Le groupe témoin de 50 patients (100 mains) a été constitué de volontaires qui ne présentaient aucun symptôme au niveau de la main. Les auteurs ont noté pour le test de Phalen une sensibilité de 85% et une spécificité de 89%, et pour le test de Hoffmann-Tinel une sensibilité de 67% et une spécificité de 68%. Ils n'ont observé aucune influence significative de l'âge des patients sur les résultats des tests. Ceux-ci étaient négatifs chez 17 patients, chez lesquels la durée des symptômes était significativement plus importante que dans le reste du groupe. Ces observations ont ainsi montré une valeur diagnostique élevée pour les tests de Phalen, mais nettement moindre pour le test de Hoffmann-Tinel. L'intérêt des deux tests dans le diagnostic des syndromes de longue durée est limité.