Sensory conduction from digit to palm and from palm to wrist in the carpal tunnel syndrome

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SUMMARY In normal subjects the maximum and minimum conduction velocity along sensory nerve was the same from digit to palm and from palm to wrist. Severe slowing from palm to wrist in patients with the carpal tunnel syndrome was often associated with only slight slowing from digit to palm. The distal slowing is attributed to a reversible constriction of nerve fibres, an assumption supported by the recovery in distal conduction velocity as early as two and a half months after decompression. The sensory velocity from wrist to elbow was normal or supernormal, whereas the motor velocity was often slightly decreased. The exclusion of the normal segment of the median nerve distal to the flexor retinaculum made it possible to demonstrate abnormalities across the flexor retinaculum in patients with clinical signs of carpal tunnel syndrome in whom distal motor latency and sensory conduction from digit to wrist were normal.

In most patients with a carpal tunnel syndrome the motor latency to the abductor pollicis muscle is prolonged (Simpson, 1956) and conduction in sensory fibres of the median nerve is slowed between digits and wrist (Gilliatt and Sears, 1958). Diagnostic difficulties arise when motor and sensory conduction are normal or only slightly slowed. It may then still be possible to find abnormalities in the segment of nerve underneath the flexor retinaculum, for then the segment from digit to palm is excluded along which conduction may be slightly impaired or normal.

In the study presented in this report we have used maximal electrical stimuli and compared the velocity in sensory fibres from palm to wrist with the velocity distal and proximal to this segment of the nerve.

METHOD

1. STIMULATION The stimulus current was a rectangular current pulse, 100 or 200 μsec in duration, delivered by a battery-operated stimulator with a constant current output of at most 100 mA. The stimulus was gradually increased until the response was maximum, and the current was recorded on a separate channel (Buchthal and Rosenfalck, 1966). The stimulating cathodes were surface ring electrodes or, to diminish the artefact,

uninsulated platinum needles, 0·3 mm in diameter' placed medially and laterally at the proximal end of the distal phalanx of digit I and at the middle phalanx of digit III and digit V. The anodes were surface ring electrodes placed 20 mm distally from the cathodes.

The earth electrode was placed around the proximal phalanx when recording in the palm and at wrist when recording proximal to the flexor retinaculum.

2. LEADING-OFF ELECTRODES These were insulated steel needles, 0·7 mm in diameter, with a bared tip of 3 mm on the electrode placed near the nerve and of 5 mm on the remote electrode. They were discarded after having been used once (Buchthal and Rosenfalck, 1971).

At the wrist (median and ulnar nerve) and at the elbow (median nerve) the electrodes were placed near the nerve by adjusting their position until the threshold of the muscle action potential was 0·5 to 1 mA. The remote electrode was placed at a transverse distance of 40 to 50 mm at the level of the near-nerve electrode.

To record from the nerve in the palm the near-nerve electrode was inserted well outside the zone of compression in the carpal tunnel, 15-20 mm distal to the distal edge of the flexor retinaculum (Robbins, 1963; Johnson and Shrewsbury, 1970). In the case of digit III the electrode was placed 90 mm from the stimulating cathode along a line pointing to the midline of digit III. To record from the palmar nerve of digit I the electrode was placed 60 mm from the cathode at the medial border

of the thenar eminence. The remote electrode was placed just below the skin either 20 to 30 mm proximally or transversely to the near-nerve electrode. No attempt was made to improve the position of the near-nerve electrode other than by slight changes in the depth of insertion. To diminish discomfort the palm was cooled by ether before insertion.

3. CONTROL OF TEMPERATURE A thermocouple on the volar surface of the forearm controlled the source of radiant heat automatically, ensuring a surface temperature of 37 to 38°C corresponding to 36 to 37°C near the nerve.

4. AMPLIFIER Recording in the palm required an amplifier with short blocking time and compensation of the stimulus artefact (Andersen and Buchthal, 1971).

5. RECORDING The sensory potentials were recorded on single sweeps, by photographic superposition of 10 to 20 potentials and, when the potentials were less than $5 \mu V$, by electronic averaging of 500 responses (Buchthal and Rosenfalck, 1971). When latencies were increased, a delay between stimulus and sampling ascertained the same resolution (number of 'points' per unit time). Potentials of 0·05 to 0·1 μV were accepted only when they could be recognized by their latency, shape, and amplitude in a subsequent sampling. For recording we have used one channel of an electromyograph (DISA 14A30) or, to obtain a better resolution in time, a cathode ray oscilloscope with a display area of 8×10 cm.

6. MOTOR CONDUCTION was determined by stimulating via the electrodes placed at wrist and elbow with a current ten times the threshold of the muscle action potential. The potential was recorded by a concentric electrode in the endplate zone of m. abductor pollicis brevis (median nerve) or of m. abductor digiti quinti (ulnar nerve) and the recording electrode was placed at the point of maximum response.

7. MEASUREMENTS a. *Conduction distance* The short distances over which velocities were calculated required that they be measured as accurately as possible. The hand was placed in a standard position with the thumb abducted to 60 degrees. Measurements were repeated and usually deviated less than 1 mm; when they deviated more a third measurement was taken and the three measurements were averaged. With a distance from the stimulating cathode on digit I to the near nerve electrode at wrist of 124 $\pm$ 3 mm (n = 34), the distance from digit I to palm was 65 $\pm$ 3 mm (n = 11) and from palm to wrist 61 $\pm$ 3 mm (n = 11). With a distance from digit III to wrist of 170 $\pm$ 3 mm (n = 35), the distance from digit III to palm was 91 $\pm$ 3 mm (n = 32) and from palm to wrist 78 $\pm$ 3 mm (n = 32). The distance from wrist to elbow was 212 $\pm$ 4 mm (n = 29).

b. *Latencies* The shortest latency of the sensory response was determined from the time to the initial positive peak, the longest latency from the time to the last separate component of the averaged potential. Motor conduction time was measured to the initial deflection from the base line. The amplitudes of the sensory and motor responses were measured peak-to-peak. The lower and upper limits of normal were obtained from plots of the cumulative distribution functions.

PATIENTS AND SUBJECTS

Twenty-two patients were studied, 16 females and six males, 29 to 67 years old, all hospitalized in neurological or neurosurgical wards. Thirteen patients had clinical signs and symptoms of carpal tunnel syndrome; in five both hands were affected. The clinical findings were equivocal in eight. In nine patients signs and symptoms had lasted for less than half a year, in three six months to one and a half years, and in 10 from two to 30 years. Force and volume of the abductor pollicis brevis muscle were normal in 14 hands; there was marked weakness and wasting in three and moderate in six hands.

ELECTROMYOGRAPHY Nineteen of 22 abductor pollicis brevis muscles were studied. Only six showed fibrillation potentials and two of these had a discrete pattern of activity during full voluntary effort indicating severe loss of motor units. An increased incidence of polyphasic potentials was found in 12 and the action potentials were prolonged in 13 muscles.

SENSORY AND MOTOR CONDUCTION IN ULNAR NERVE The normal sensory conduction from digit V to wrist (54 m/sec, SD 5 m/sec) as well as the normal latency from wrist to m. abductor digiti quinti (2·7 msec, SD 0·3 msec, 70 mm) found in all patients helped to exclude that the impairment of the median nerve was associated with a generalized neuropathy.

The 10 normal subjects, five females and five males, were 32 to 57 years old and had no signs or symptoms of neuromuscular impairment.

RESULTS

In the normal subjects and the patients the conduction velocity was determined in sensory fibres between digit and palm, digit and wrist, palm and wrist, and wrist and elbow by stimulating the branches to digits I and III of the median nerve.

1. NORMAL SUBJECTS (Fig. 1) The error in determining the velocity from digit to palm due to proximal displacement of the point of stimulation relative to the position of the cathode (Rushton, 1949) was 2 to 5% when the stimulus was varied from being slightly submaximal to supramaximal. To minimize this error the response to the maximal stimulus was selected for measurement (Fig. 2). The error was then negligible, since the velocity was the same from digit to palm as from palm to wrist.

The error in determining the conduction velocity due to measuring the distance on the surface was evaluated from the true length of the nerve measured
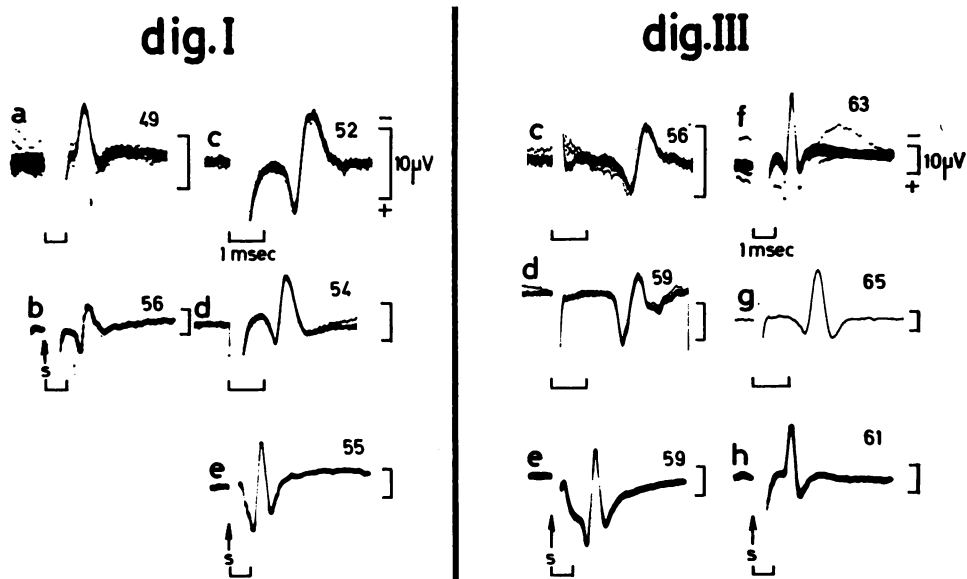
dig.I   dig.III

FIG. 1.   *Sensory potentials recorded from median nerves in the palm of normal subjects.* Left, *maximal stimuli to digit I (five normal subjects, a-e)*; right, *to digit III (three of the same subjects, c-e, and three other subjects, f-h). Temperature near the nerve 36°C. The figures above each trace indicate the maximum conduction velocity (m/sec) measured to the initial positive peak (remote electrode transversely to the near-nerve electrode) or to the onset of the negative deflection (electrodes along the nerve).*
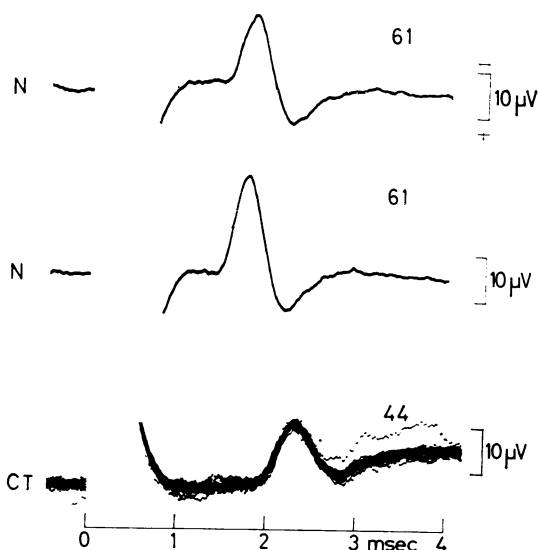
at necropsy in 14 victims of traffic accidents. The points measured from the wrist, distal phalanx of digit I, and middle phalanx of digit III were marked by a needle. The distance was measured on the surface with the hand stretched and digit I abducted to 60 degrees. The nerve was then exposed and measured in the same position by placing a wire (0·5 mm) from needle to needle along the nerve to digit III and along the lateral and medial branches of the nerve to digit I (Table 1). In the case of digit III

FIG. 2.   *Unchanged latency of the sensory potential s a palm in normal median nerve (N) when the stimulus to digit III was increased from submaximal (18 mA, above) to maximal (30 mA, middle) (temperature near the nerve 36°C). Below (CT): Maximal response at palm in a patient with carpal tunnel syndrome in whom the conduction velocity from palm to wrist was 26 m/sec. The figures above each trace indicate the maximal conduction velocity to palm (m/sec).*

TABLE 1

DISTANCE (MM) FROM PHALANGES TO WRIST MEASURED
POST MORTEM ON SURFACE AND ALONG NERVE*

No.	Surface	Digit I to wrist		Digit III to wrist	
		nerve		surface	nerve
		lat. branch	med. branch		
1	112	112	113	174	177
2	114	114	—	168	169
3	112	119	112	163	161
4	98	104	105	151	151
5	112	120	119	170	169
6	107	115	113	167	165
7	104	110	107	156	159
8	122	121	121		
9	116	114	110		
10	112	120	109		
11	120	120	121		
12	106	111	109		
13	121	124	123		
14	111	113	117		

*Fourteen hands: each value is the mean of four measurements.

the distance along the surface was at most 2% shorter or 1% longer than the distance measured along the exposed nerve. In the case of digit I the distance was at most 7% shorter or 5% longer than measured along the nerve. Thus, on the average, measuring the distance on the surface gives a velocity from digit III to wrist which is 0·2% too fast and from digit I to wrist 3% too slow.

The maximum conduction velocity to palm was the same as to wrist, 60 m/sec, SD 3·5 m/sec, when stimulating digit III, and 53 m/sec, SD 5 m/sec, when stimulating digit I (Fig. 3). Velocities less than 53 m/sec from digit III to palm and to wrist and of less than 52 m/sec across the flexor retinaculum were abnormal (P < 0·05). This is similar to the velocity across the carpal tunnel of 54·43 m/sec, SD 10·26 m/sec reported by Wiederholt (1970) in normal subjects over a segment of 3·8 cm, taking into account that the temperature was 4°C lower than
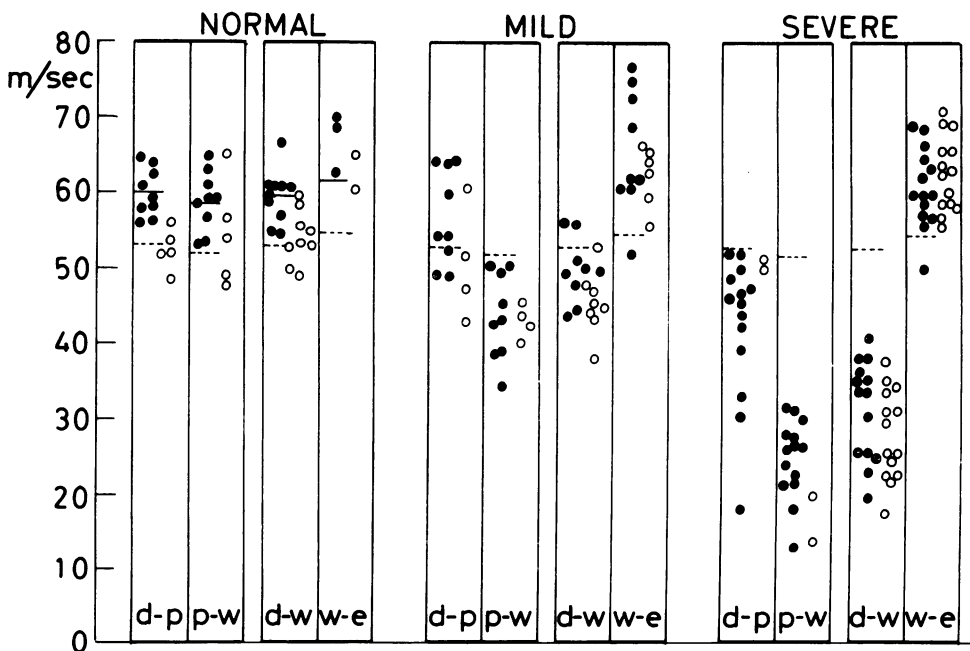

FIG. 3.   *Conduction velocity in sensory fibres of the median nerve in normal subjects and in patients with carpal tunnel syndrome (temperature near the nerve 36°C). Maximal stimuli to digit III ●, and to digit I ○. Normal: normal subjects; mild: patients with slight slowing from digit to wrist; severe: patients with marked slowing. Conduction velocity (scale m/sec on the left) d-p, digit to palm; p-w, palm to wrist; d-w, digit to wrist; w-e, wrist to elbow. The solid lines indicate the mean normal conduction velocity, the dashed lines the lower limits of normal (P < 0·05). The mean value for the velocity from wrist to elbow is taken from Buchthal and Rosenfalck (1966) corrected for the slightly higher temperature in this study.*

in our measurements. The minimum velocity to palm and to wrist determined by photographic superposition averaged 34 m/sec, SD 4 m/sec. The amplitude of the sensory potential, evoked by a maximal stimulus to digit III and recorded in the palm, averaged 25 μV, about 10 μV higher than at the wrist, consistent with a smaller temporal dispersion over the shorter distance of conduction (Fig. 4).

2. TWENTY-TWO PATIENTS WITH CARPAL TUNNEL SYNDROME a. *Thirteen patients (14 hands) with markedly slowed conduction from digit to wrist (Fig. 3, severe)* In ten nerves the maximum velocity of conduction was slower across the flexor retinaculum than distal to it by 10 to 30 m/sec (Fig. 5). In four nerves the velocity was as slow from digit to palm as from palm to wrist (Fig. 6). The minimum velocity to the wrist was about 10 m/sec less than to the palm. The temporal dispersion at the palm was slightly greater than in the normal subjects as indicated by a longer time from the positive to the negative peak of the potential. With few exceptions the potentials at the wrist were split up into many components.

FIG. 4. *Peak-to-peak amplitude of the sensory potential of the median nerve evoked by a maximal stimulus to digit III (temperature near the nerve 36°C). Normal: normal subjects; mild: patients with slight slowing from digits to wrist; severe: patients with marked slowing. Amplitude (log scale, μV, on the left).* p: *recorded at palm,* w: *recorded at wrist. The solid lines indicate the mean normal amplitude, the dashed lines the lower limits of normal* (P < 0·05).

The amplitude of the sensory potential at the wrist was always smaller than in normals, in most patients less than 3 μV, and had to be averaged electronically (Fig. 4). The amplitude at the palm was lower than normal, whether the conduction velocity from digit to palm was nearly normal (seven nerves) or markedly slowed (seven nerves). Though lower than normal, the amplitude at the palm was higher than at the wrist in nine of 14 nerves (Fig. 4).

The maximum velocity along sensory fibres from wrist to elbow was normal, in a third even above normal (Fig. 3). The latency from the wrist to m. abductor pollicis brevis was increased in eight (5 to 8 msec) and normal or borderline in six hands. Motor fibres between elbow and wrist conducted markedly slower than the normal average in one, slightly slower in six (10 to 15%), and normally in seven nerves (Fig. 7).

b. *Nine patients with borderline or slightly slowed maximum and normal minimum conduction velocity from digit to wrist (Fig. 3, mild)* The maximum velocity of conduction across the flexor retinaculum was below the normal range in all, about 30% below the normal average (Fig. 3). In nine of the 13 branches of the median nerves examined between digits and palm the conduction velocity was normal (Fig. 8), though often near the lower limit; in three nerves conduction was 10-20% below the lower limit of normal. Neither the shape nor the amplitude of the potentials at the wrist gave a definite clue as to an increased temporal dispersion across the flexor retinaculum: The shape was normal or there were only slight irregularities in the potential (Fig. 8). The amplitude was within the normal range in more than half of the median nerves examined (illustrated for digit III in Fig. 4). The shape and amplitude of the potential recorded at the palm were normal (Fig. 4). Sensory conduction between wrist and elbow was normal or above normal (Fig. 3). The distal motor latency and the amplitude of the muscle action potential were normal in all but one and motor conduction from elbow to wrist was normal in all patients (Fig. 7).

3. EFFECT OF DECOMPRESSION Two patients (three nerves) with severe slowing from palm to wrist (maximum conduction velocities of 14, 24, and 32 m/sec) were reexamined 74 and 91 days after surgical division of the flexor retinaculum (Fig. 9). The maximum conduction velocity in the sensory fibres of the median nerve had increased by 10 m/sec or more, the increase being more pronounced across the flexor retinaculum (70%) than from digit to wrist (35%). The velocities from digit to palm, which were at the lower limit of normal before decom-
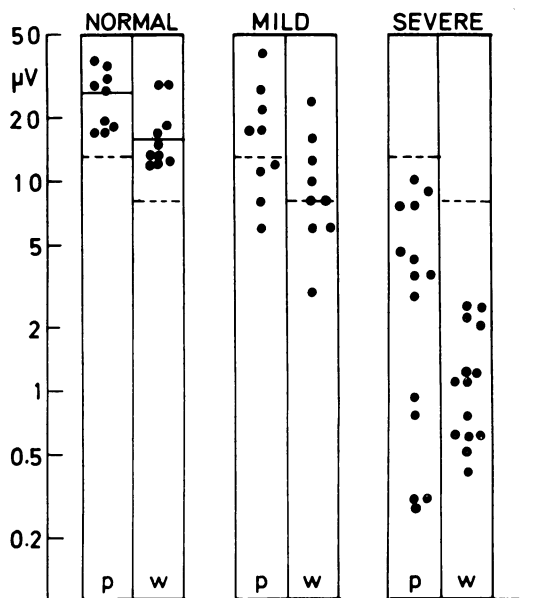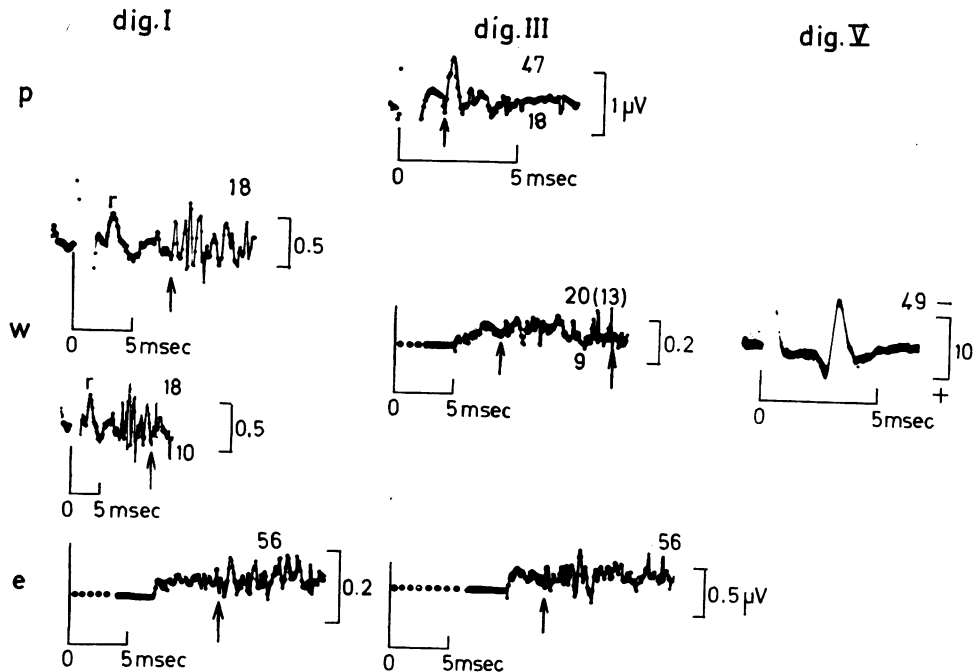
FIG. 5. *Sensory potentials in a patient with carpal tunnel syndrome (temperature near the nerve 36°C). The decrease in maximum velocity was four times greater across than distal to the flexor retinaculum. Left: sensory potentials in the right median nerve evoked by maximal stimuli to digit I (65 mA) and to digit III (20-65 mA) and recorded at palm (p, digit III), wrist (w, two time bases to identify minimum and maximum latency, components at arrows) and elbow (e). The potentials were recorded by electronic averaging of 500 responses with the same number of points per time unit. The use of a delay before sampling is indicated by the dotted lines. Note the potential from the radial nerve (r) in the recording at wrist (58 m/sec digit I). Right: sensory potentials in the right ulnar nerve evoked by maximal stimuli to digit V (60 mA). Photographic superposition of 20 responses. The figures above each trace indicate the maximum and the figures below each trace the minimum sensory conduction velocity distal to the point of recording; in brackets maximum velocity from palm to wrist (m/sec) A 55 year old skilled worker who for three months had had pain and tingling in the right digits I, II, and III which could waken him from sleep. There was slight wasting and normal force in the m. abductor pollicis brevis. The sensitivity to pin-prick and touch was normal. The distal latency to m. abductor pollicis brevis was 8·6 msec (80 mm), the velocity from elbow to wrist 51 m/sec.*

pression, were 7 to 9 m/sec faster after decompression (15%). The motor latency had shortened from 5·5 to 4 and from 4·5 to 3·5 msec (56 mm).

DISCUSSION

The determination of the velocity of conduction both from digit to palm and from palm to wrist has made it possible to identify slowing in conduction along the median nerve in patients in whom conventionally recorded sensory and motor latencies were normal. Since the segment of the nerve from digit to palm was but little impaired its exclusion enhances the degree of abnormality which can be demonstrated (Fig. 8). Thus, in six of eight patients

with complaints suggestive of a carpal tunnel syndrome in whom motor latency was normal and sensory conduction to the wrist near normal, the maximum velocity from palm to wrist was significantly decreased (Fig. 3). Even in the more severely affected patients the potential at the palm was less abnormal than at the wrist both with respect to conduction velocity and to amplitude.

McLeod (1966) recorded the velocity of conduction along the digital nerves in patients with a carpal tunnel syndrome. The sensory potentials evoked by tapping the nail (by the method of Sears (1959) and Bannister and Sears (1962)) could not be discriminated at the wrist, and conduction from digit to wrist and along the digital nerves could not be
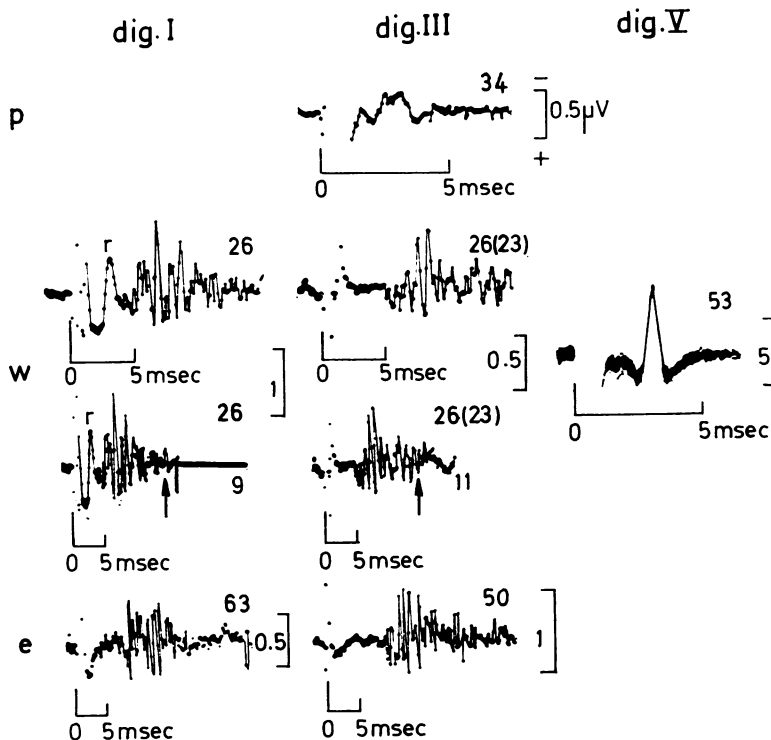
FIG. 6. *Sensory potentials in a patient with carpal tunnel syndrome (temperature near the nerve 36°C). The decrease in maximum velocity was equally pronounced across the flexor retinaculum as distal to it. Left: sensory potentials in the right median nerve evoked by maximal stimuli to digit I (70 mA) and to digit III (30 mA) and recorded at palm (p, digit III), wrist (w, two time bases to identify mimimum and maximum latency) and elbow (e). The potentials were recorded by electronic averaging of 500 responses with the same number of points per time unit. Note the potential from the radial nerve (r) in the recording at wrist (51 m/sec, digit I). Right: sensory potentials in the right ulnar nerve evoked by maximal stimuli to digit V (60 mA). Photographic superposition of 20 responses. The figures above each trace indicate the maximum and the figures below each trace the minimum sensory conduction velocity (component at arrow) distal to the point of recording; in brackets maximum velocity from palm to wrist (m/sec). A 63 year old housewife whose symptoms began 20 years ago and had increased considerably in the past two years. She complained of pain and tingling which could waken her from sleep and was most pronounced in digits III and IV. She was operated for a 'scalenus anticus syndrome' three months ago without relief of pain. The force and volume of m. abductor pollicis brevis were normal. There was decreased sensitivity to touch and pin-prick in the area of the median nerve. The distal latency to m. abductor pollicis brevis was 5·7 msec (70 mm), the velocity from elbow to wrist 42 m/sec.*

compared. McLeod (1966) found slowing in 16 of the 22 digital nerves examined. Distal slowing was more pronounced in his than in our severely affected patients, due either to more advanced impairment or to the additional decrease in velocity of 10 m/sec which he found when he measured to the negative peak of temporally dispersed potentials.

Most of the nerves in which we have found marked slowing at the wrist conducted at a nearly normal velocity from digit to palm and the response at the palm was better synchronized and had an amplitude up to 10 times larger than at the wrist. This corresponds to the lesser slowing in the forearm than across the cubital sulcus in patients with a compression syndrome of the ulnar nerve (Payan, 1969).

Animal experiments have shown that compression of the nerve causes (1) a reduction in the diameter of nerve fibres ('constriction' (Weiss and Davis, 1943; Weiss and Hiscoe, 1948; Weiss and Cavanaugh, 1959; Andersson, 1970)). (2) demyelination; and (3) axonal degeneration (Denny-Brown and Brenner, 1944; Fullerton and Gilliatt, 1967a and b).
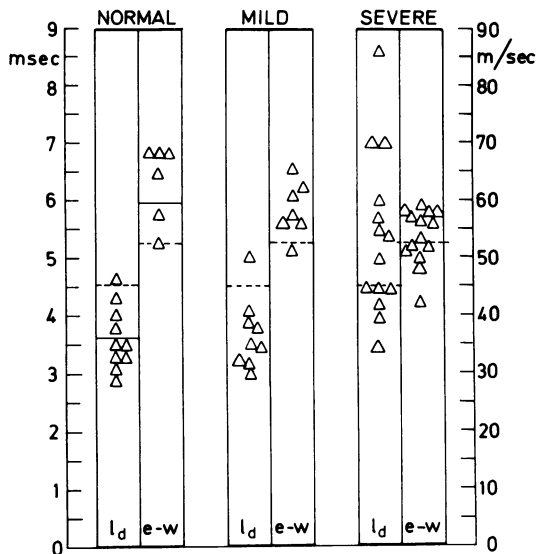
FIG. 7. *Conduction in motor fibres of the median nerve in normal subjects and in patients with carpal tunnel syndrome (temperature near the nerve 36°C). Supramaximal stimuli applied at wrist and elbow and recording from m. abductor pollicis brevis. Normal: normal subjects; mild: patients with slight slowing along sensory fibres from digit to wrist; severe: patients with marked slowing along sensory fibres. l_d: Latency from wrist to m. abductor pollicis brevis (left ordinate msec) corrected to a standard distance of 64 mm. e-w: Conduction velocity from elbow to wrist (right ordinate m/sec). The dashed lines indicate the upper limit of normal distal latency and the lower limit of normal conduction velocity ($p < 0.05$). The mean conduction velocity (solid lines) in normal subjects is taken from Lamontagne and Buchthal (1970) corrected for the slightly higher temperature in this study.*
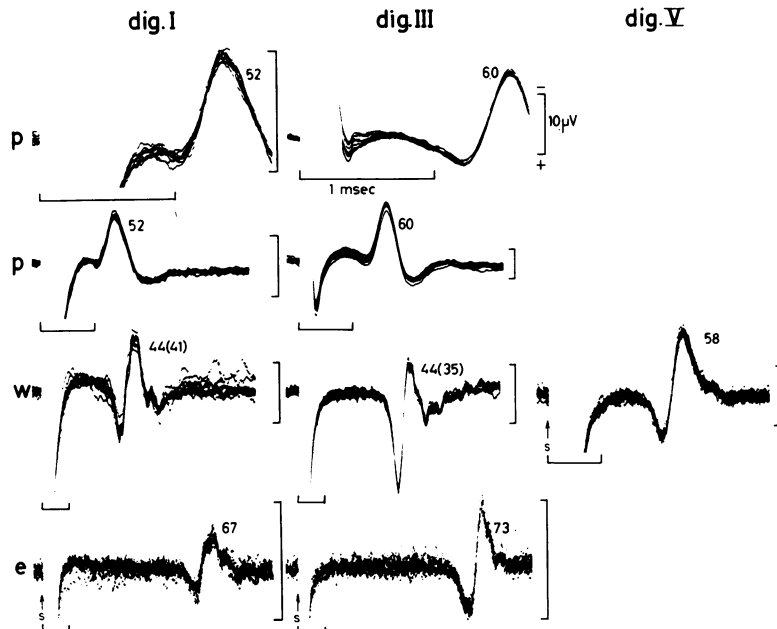

FIG. 8. *Sensory potentials in a patient with complaints suggestive of carpal tunnel syndrome. The conduction from digit to wrist was borderline (dig. I) or slightly reduced (digit III) (temperature near the nerve 36°C). Left: sensory potentials in the right median nerve evoked by maximal stimuli to digits I and III (35 mA) and recorded at palm (p, two time bases), wrist (w), and elbow (e). Right: sensory potentials in the right ulnar nerve evoked by maximal stimuli to digit V (32 mA). Photographic superposition of 10 responses. The figures above each trace indicate the maximum sensory conduction velocity (m/sec) distal to the point of recording; in brackets velocity from palm to wrist, 40% decreased. A 49 year old housewife who for 14 years had had intermittent pain and tingling in digits I to IV of both hands and in the forearms which could waken her from sleep. The basic metabolic rate was normal. The force and volume of m. abductor pollicis brevis were normal as was the sensitivity to touch and pin-prick. The distal latency to m. abductor pollicis brevis was 3·8 msec (60 mm), the velocity along motor fibres from elbow to wrist 66 m/sec.*
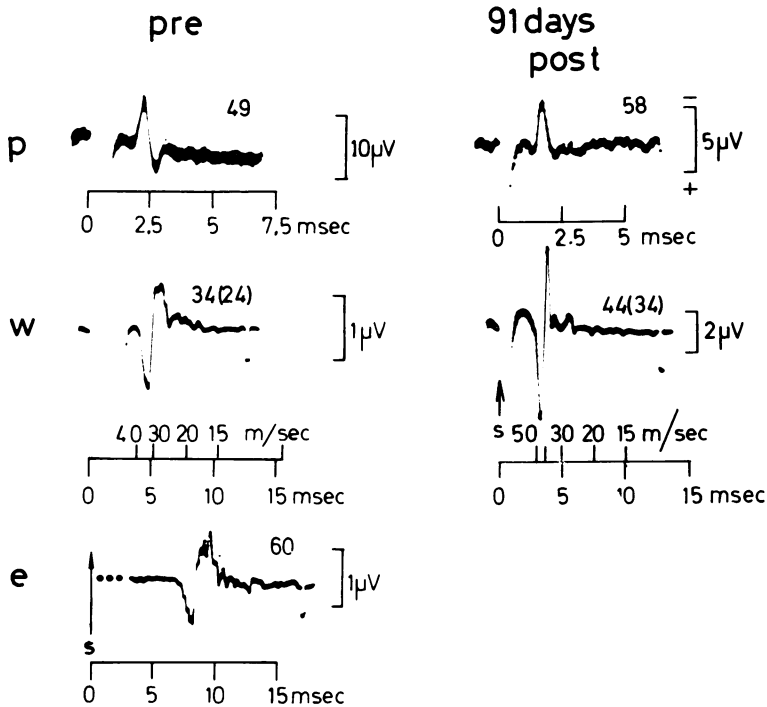
FIG. 9.   *Recovery of sensory potentials in a carpal tunnel syndrome after surgical section of the flexor retinaculum. Sensory potentials in the left median nerve evoked by maximal stimuli* (s) *to digit III (25 mA) and recorded at palm* (p), *wrist* (w), *and elbow* (e, *3 msec delay) before* (pre) *and 91 days post* (after) *decompression (temperature near the nerve 36°C). The figures above each trace indicate the maximum velocity (m/sec) distal to the point of recording; in parentheses velocity from palm to wrist. The potentials were recorded by electronic averaging of 500 responses. Fifty-one year old housewife who had numbness and tingling in the left hand and forearm for three years with pain which could waken her from sleep. The force and volume of the intrinsic muscles of the hand were normal and there was normal sensitivity to touch and pin-prick in the region of the median nerve. The motor latency to the m. abductor pollicis brevis was 5·5 msec before and 4·0 (56 mm) 91 days after decompression. The conduction velocity along motor fibres from elbow to wrist was 56 m/sec.*

In our patients with severe impairment the amplitude of the sensory potentials at the palm was markedly reduced, sometimes as much as at the wrist. Unlike the potentials at the wrist the potentials at the palm were split up less or not at all. Hence, the increased temporal dispersion could not account for amplitudes which were less than half of normal and many nerve fibres had ceased to conduct (Buchthal and Rosenfalck, 1971). When the surviving fibres conducted at a near normal rate from digit to palm, one must assume unselective loss of fibres, 6-12 μ in diameter (Fig. 5 and 9). When conduction from digit to palm was slowed, the cause is either a decrease in diameter of the nerve fibres (Weiss and Cavanaugh, 1959) or a loss of large fibres (Thomas and Fullerton, 1963).

Whatever the main lesion, in most of our patients many nerve fibres conducted at a normal rate, or conduction was only slightly slowed distal to the zone of compression (digits to palm). In rabbit nerve conduction seems to approach normal distal to a 2 mm demyelinated segment (Lehmann and Pretschner, 1966).

An experimental compression causes a reduction in fibre diameter distal to it which is reversible after decompression (Weiss and Cavanaugh, 1959). Such decrease in diameter distal to the zone of compression seems a reasonable explanation of the slight slowing between digits and palm. The velocity of conduction between digit and palm was increased to well within the normal range as early as two to three months after decompression (Fig. 9), so soon that an

increase in diameter is a more plausible explanation than outgrowth of nerve fibres or remyelination.

The maximum sensory velocity between wrist and elbow was above the lower limit of normal in all but one, and in one third of the nerves even above the upper limit of normal (Fig. 3). Whether this 'super-conductivity' is due to the increase in fibre diameter proximal to a compression (Weiss and Cavanaugh, 1959) can be decided only by experiments in which electrophysiological and histological findings can be related. Conduction in the proximal segment of motor fibres was slightly slowed when impairment was severe (Fig. 7) confirming findings of Simpson (1956), Thomas (1960), Ebeling, Gilliatt, and Thomas (1960), Kaeser (1963), and Thomas, Lambert, and Cseuz (1967). We have no explanation for the difference between proximal conduction in sensory and motor fibres, nor is evidence available as to whether the proximal slowing in motor fibres is diminished after decompression.

We have previously found that conduction from digit I to wrist was 6 to 7 m/sec slower than from digit III to wrist (Buchthal and Rosenfalck, 1966). A similar difference was found in the present study. A small part of this difference was due to a systematic error in the measurement of the distance from digit I to wrist. This error was avoided when the potentials were recorded at the palm. Hence, the 8 m/sec slower velocity from digit I than from digit III to palm (Fig. 3) is real and probably due to the stimulation of more distal branches of the nerve in the distal phalanx of digit I.

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