

F-Wave Analysis in Patients with Clinically Diagnosed Carpal Tunnel Syndrome

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Background and Objective : Carpal tunnel syndrome (CTS) is the most common mononeuropathy encountered in clinical practice. No single procedure or group of procedures has demonstrated adequate sensitivity. F-wave study in CTS is very rarely reported. To determine the diagnostic usefulness of new parameters of F-wave and comparative study of F-wave parameters of median and ulnar nerves in patients with CTS.

Methods : F-wave responses of median and ulnar nerves were analyzed from 27 patients with clinically diagnosed CTS and 22 age and gender-matched normal control. Conventional F-wave parameters were studied. Also, the usefulness of new parameters such as mean and maximal ulnar-median F-wave latency differences, ulnar-median F-wave persistence and chronodispersion differences, median/ulnar F-wave amplitude ratio, and F-wave conduction velocity (FCV) using mean and maximal latency were assessed.

Results : Compared with controls, median F-wave minimal, maximal and mean latencies, mean F-wave amplitude/M-wave amplitude, minimal, mean and maximal ulnar-median F-wave latency differences, and FCVs using minimal, maximal and mean latency were significant ($P < 0.05 \sim 0.001$). Median F-wave minimal, maximal and mean latencies, mean ulnar-median F-wave latency difference, and FCVs using minimal, maximal and mean latency showed high sensitivity and specificity. Mean ulnar-median F-wave latency difference and FCVs using maximal and mean latency were new parameters.

Conclusion : New F-wave parameter including mean ulnar- median F-wave latency difference and FCVs using maximal and mean latency may be a useful to assess the CTS. Also, median F-wave minimal, maximal and mean latencies, and FCV using minimal latency may be included in routine diagnostic tests in CTS.

Key Words : Carpal Tunnel Syndrome, F-wave, Median nerve, Ulnar nerve, Latency, Parameter

(carpal tunnel syndrome) 가 (median nerve) 가 , F (supramaximal stimulation) , Charcot - Marie - Tooth , Guillain - Barre 가

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latency) 가
 가 . F
 (mean duration),
 nodispersion, F
 (parameter)

2) Filter setting
 (filter setting) 10 Hz~10
 kHz, 20 Hz~5 kHz, F 2 Hz~10 kHz
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F ,⁶⁻⁹ F
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3) F
 F , M F ,
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4)
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2. (terminal latency) 4.7 ± 1.7 msec, (2nd digit to wrist and palm to wrist velocity) 34.2 ± 5.4 m/sec, (2nd digit to wrist amplitude) 14.8 ± 7.5 μ V (P<0.001). (palm to wrist amplitude) 8.1 (P=0.06).

3. (P<0.01). (P<0.05-0.001). chronodispersion (Table 1).

4. F chronodispersion (Table 2).

5. (P<0.05). (P<0.05). (P<0.05).

Table 1. F-wave parameters in CTS patients and control subjects

Parameter	CTS (n=49)	Control (n=44)	P-value
Median F-wave minimal latency (m/sec)	26.0 \pm 2.4	23.1 \pm 1.2	0.000
Median F-wave maximal latency (m/sec)	29.6 \pm 3.1	26.3 \pm 2.1	0.000
Median F-wave mean latency (m/sec)	27.7 \pm 2.6	24.4 \pm 1.3	0.000
Median F-wave chronodispersion (m/sec)	3.67 \pm 1.83	3.08 \pm 1.30	0.121
Median F-wave persistence (%)	87.1 \pm 12.5	88.1 \pm 10.4	0.650
Median F-wave mean amplitude (mV)	0.27 \pm 0.12	0.30 \pm 0.14	0.364
Median mF/M ratio	0.03 \pm 0.01	0.02 \pm 0.09	0.025
Minimal U-M F-wave latency difference (m/sec)	-0.96 \pm 1.48	-0.04 \pm 1.36	0.001
Maximal U-M F-wave latency difference (m/sec)	-1.82 \pm 2.55	-0.05 \pm 2.28	0.000
Mean U-M F-wave latency difference (m/sec)	-1.37 \pm 1.59	0.17 \pm 1.20	0.000
Persistence U-M F-wave difference (%)	-1.12 \pm 15.28	-0.91 \pm 14.52	0.954
CD U-M F-wave latency difference (m/sec)	-0.86 \pm 1.95	0.02 \pm 2.34	0.053
M/U F-wave amplitude ratio	1.72 \pm 1.11	1.51 \pm 1.32	0.424
FCV minimal (m/sec)	59.8 \pm 7.3	64.9 \pm 5.5	0.000
FCV maximal (m/sec)	51.1 \pm 7.4	56.2 \pm 4.6	0.000
FCV mean (m/sec)	55.1 \pm 6.9	61.0 \pm 5.3	0.000

Plus-minus values are means \pm SD.

CTS; carpal tunnel syndrome, mF/M; mean F-wave amplitude/M-wave amplitude, U; ulnar, M; median, CD; chronodispersion, FCV; F-wave conduction velocity.

(Table 3).

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Table 2. The diagnostic sensitivity and specificity of F-wave parameters

Parameter	Sensitivity (%)	Specificity (%)
Median F-wave minimal latency	83.7	75.0
Median F-wave maximal latency	67.4	75.0
Median F-wave mean latency	55.1	84.1
Median F-wave chronodispersion	20.4	75.0
Median F-wave persistence	42.9	75.0
Median F-wave mean amplitude	20.4	84.1
Median amplitude (mF/M)	38.8	75.0
Minimal U-M F-wave latency difference	36.8	68.2
Maximal U-M F-wave latency difference	30.6	75.5
Mean U-M F-wave latency difference	61.2	68.2
Persistence U-M F-wave difference	20.4	79.6
CD U-M F-wave latency difference	98.8	18.2
M/U F-wave amplitude ratio	16.3	88.6
FCV minimal	57.1	75.0
FCV maximal	57.1	75.0
FCV mean	69.4	72.7

mF/M; mean F-wave amplitude/M-wave amplitude, U; ulnar, M; median, CD; chronodispersion, FCV; F-wave conduction velocity.

Table 3. F-wave differences between demyelinating and axonal type in CTS patients

Parameter	Control (n=44)	Demyelinating (n=32)	Axonal (n=17)
Median F-wave minimal latency (m/sec)	23.1±1.2	25.5±2.0	26.9±2.7**
Median F-wave maximal latency (m/sec)	26.3±2.2	29.0±2.4*	30.7±3.8*
Median F-wave mean latency (m/sec)	24.4±1.3	27.0±2.0	29.0±3.7**
Median F-wave chronodispersion (m/sec)	3.1±1.3	3.6±1.5	3.8±2.4
Median F-wave persistence (%)	88.1±10.4	87.7±12.4	86.5±13.1
Median F-wave mean amplitude (mV)	0.30±0.14	0.26±0.10	0.29±0.16
Median mF/M ratio	0.02±0.09	0.02±0.01	0.03±0.01****
Minimal U-M F-wave latency difference (m/sec)	-0.04±1.36	-0.99±1.09***	-0.91±2.07
Maximal U-M F-wave latency difference (m/sec)	-0.05±2.28	-1.87±1.70*	-1.74±3.70*
Mean U-M F-wave latency difference (m/sec)	0.17±1.20	-1.20±1.07*	-1.69±2.30*
Persistence U-M F-wave difference (%)	-0.91±14.52	-0.78±14.03	-1.76±17.85
CD U-M F-wave latency difference (m/sec)	0.02±2.34	-0.87±1.69	-0.83±2.42
M/U F-wave amplitude ratio	1.51±1.32	1.55±0.74	2.03±1.58
FCV minimal (m/sec)	64.9±5.5	59.3±5.5***	60.5±10.0
FCV maximal (m/sec)	56.2±4.6	50.5±4.8***	52.1±10.8
FCV mean (m/sec)	61.0±5.3	50.0±4.8*	55.4±10.0*

Plus-minus values are means±SD.

CTS; carpal tunnel syndrome, mF/M; mean F-wave amplitude/M-wave amplitude, U; ulnar, M; median, CD; chronodispersion, FCV; F-wave conduction velocity.

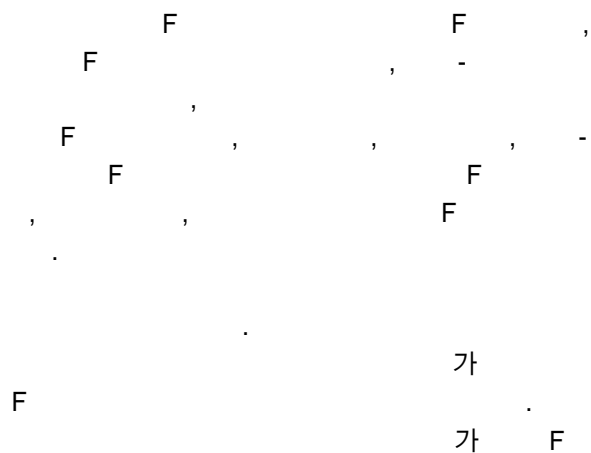
*; control versus demyelinating or axonal; P<0.05

**; control or demyelinating versus axonal; P<0.05

***; control versus demyelinating; P<0.05

****; control versus axonal; P<0.05

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