Original Article

Effect of Elbow Position on Short-segment Nerve Conduction Study in Cubital Tunnel Syndrome

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Abstract

Background: The appropriate elbow position of short-segment nerve conduction study (SSNCS) to diagnose cubital tunnel syndrome (CubTS) is still controversial. The goal of this study was to determine the effect of different elbow positions at full extension and 70° flexion on SSNCS in CubTS.

Methods: In this cross-sectional study, the clinical data of seventy elbows from 59 CubTS patients between September, 2011 and December, 2014 in the Peking University First Hospital were included as CubTS group. Moreover, thirty healthy volunteers were included as the healthy group. SSNCS were conducted in all subjects at elbow full extension and 70° elbow flexion. Paired nonparametric test, bivariate correlation, Bland–Altman, and Chi-squared test analysis were used to compare the effectiveness of elbow full extension and 70° flexion elbow positions on SSNCS in CubTS patients.

Results: Data of upper limit was calculated from healthy group, and abnormal latency was judged accordingly. CubTS group's latency and compound muscle action potential (CMAP) of each segment at 70° elbow flexion by SSNCS was compared with full extension position, no statistically significant difference were found (all $P > 0.05$). Latency and CMAP of each segment at elbow full extension and 70° flexion were correlated (all $P < 0.01$), except the latency of segment of 4 cm to 6 cm above elbow ($P = 0.43$), and the latency ($P = 0.15$) and the CMAP ($P = 0.06$) of segment of 2 cm to 4 cm below elbow. Bivariate correlation and Bland–Altman analysis proved the correlation between elbow full extension and 70° flexion. Especially in segments across the elbow (2 cm above the elbow and 2 cm below it), latency at elbow full extension and 70° flexion were strong direct associated ($r = 0.83$, $P < 0.01$; $r = 0.55$, $P < 0.01$), and so did the CMAP ($r = 0.49$, $P < 0.01$; $r = 0.72$, $P < 0.01$). There was no statistically significant difference in abnormality of each segment at full extension as measured by SSNCS compared with that at 70° flexion ($P > 0.05$, respectively).

Conclusions: There was no statistically significant difference in the diagnosis of CubTS with the elbow at full extension compared with that at 70° flexion during SSNCS. We suggest that elbow positon at full extension can also be used during SSNCS.

Key words: Cubital Tunnel Syndrome; Elbow Position; Inching Test; Short-segment Nerve Conduction Study; Ulnar Nerve

Introduction

Cubital tunnel syndrome (CubTS) is the second most common peripheral mononeuropathy, and electrophysiological studies are the key method to confirm the CubTS diagnosis.[1,2] Our previous researches showed that short-segment nerve conduction study (SSNCS, also named inching test) could precisely localize the entrapment lesions in patients with CubTS and might be a useful tool for the detection of ulnar neuropathy at the elbow,[1,2] while further questions arose from these previous researches, including which was the most appropriate position of the elbow during SSNCS test for suspected CubTS.

A study showed that ulnar nerve displacement caused by elbow flexion during SSNCS may lead a more significant technical error than routine nerve conduction study (NCS).[3] However, there are few studies about the influence of the elbow position in SSNCS.

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This study was designed to determine whether the results of the ulnar nerve detected by SSNCS with the elbow at 70° flexion were different from that at full extension. The results will help neurophysiologists determine the appropriate position of the patient's elbow during SSNCS.

Methods

Participants

This cross-sectional study included 59 CubTS patients (35 men, 24 women) in CubTS group, mean age 51.1 ± 13.5 years (range: 18–83 years), all of whom recruited from outpatients of the Peking University First Hospital between September, 2011 and December, 2014. There were seventy (27 right and 43 left) elbows included, among them 11 patients had bilateral lesions (eight men, three women). Approval from the hospital Institutional Review Board was obtained prior to the study. Written informed consents, in which the potential risks of SSNCS were outlined, were obtained from the participants before the procedure. Inclusion criteria required a diagnosis of CubTS according to guidelines provided by the American Association of Neuromuscular and Electrodiagnostic Medicine:[4] (1) symptoms of impairment of ulnar nerve, such as paresthesia of the digitus annularis and digitus minimus, hand clumsiness, atrophy of hypothenar muscles, weakness of the muscles dominated by the ulnar nerve, pain, or numbness in ulnar nerve dominated area, positive Froment's sign, positive Wartenberg's sign, and so on; (2) routine motor NCS results suggested CubTS; (3) informed consent signed; and (4) age between 18 and 85 years old. Exclusion criteria: (1) any known cause of nerve dysfunction other than compression, including diabetes mellitus, hepatic and renal dysfunction, cervical spondylopathy, history of arm trauma, malignant carcinoma, or toxicosis (e.g., alcohol), hypothyroidism, amyloidosis, Vitamin B12 deficiency, connective tissue disease, infection, and hereditary disease; (2) severe deformation of the upper limb so that the patients could not perform neurophysiological tests; and (3) neurophysiological test abnormalities found in any nerve other than the ulnar nerve.

The healthy group consisted of sixty arms from thirty healthy sex- and age-matched volunteers (12 men, 18 women), mean age 47.6 ± 6.4 years (range: 24–78 years). The mean age of patients in the healthy group was compared to that in the CubTS group, no statistically significant difference was found ($P = 0.69$). All volunteers were normal in routine NCS.

Short-segment nerve conduction study

Neurophysiological tests were performed with a keypoint electromyography machine (Keypoint, Bendimed, Denmark). The sensitivity setting of 2–10 mv/division, sweep speed of 2 millisecond/division, filter setting of 2 Hz to 10 KHz, and a 0.1-millisecond^2 wave pulse were maintained throughout all measurements. Seven markers were taken as following: drawing a line from the medial epicondyle of the humerus to the apex of olecranon, marking the midpoint of this line, from this midpoint six stimulation markers were placed, respectively, along the course of the ulnar nerve at 2 cm intervals. The seven markers were listed as following: 6 cm below the midpoint (BE6), 4 cm below the midpoint (BE4), 2 cm below the midpoint (BE2), the midpoint (E), 2 cm above the midpoint (AE2), 4 cm above the midpoint (AE4), and 6 cm above the midpoint (AE6). The ulnar nerve was stimulated with the cathode at each marker. The recording electrode was placed over the belly of the abductor digiti minimi, and the reference electrode was placed over its distal tendon. Subjects were in a warm, shielded, and quiet room and asked to lie in a supine position and relax during testing. The room temperature was maintained at 22–25°C, and extremity skin temperature was measured at 32°C or above.

Before tests were performed, we ensured that supramaximal stimulation was achieved and adequate pressure was applied to the stimulating electrodes to enable focal stimulation without the spread. Latencies were measured from stimulus to onset of compound muscle action potential (CMAP), and the amplitude measurements were calculated from baseline to negative peak. The latency and CMAP of each segment were recorded.

All subjects were first tested with the upper limbs abducted to 70° from horizontal by a goniometer fixed at 70°, with the forearm supinated and the wrist in neutral position, then the seven markers were drawn and stimulated. The elbow was then adjusted to full extension, 0° from horizontal. After repositioning, the seven markers were drawn again and stimulated. SSNCS was performed with the elbow in both positions (full extension and 70° flexion) and data were recorded.

Abnormal criteria

Practice parameters for electrophysiological diagnostic criteria of ulnar neuropathy at the elbow:[4] (1) the nerve conduction time of each segment was mean + 2 standard deviations (SDs) longer than the same segment in the healthy group; (2) conduction block was found in proximal segment compared with the successive distal segment that CMAP was reduced by 20% or more and duration was increased by 10% or less.

Statistical analysis

The statistical package SPSS 14.0 was used to analyze data (SPSS Inc., Chicago, IL, USA). Data of the healthy group that was distributed in a normal fashion was expressed as the mean ± SD, and independent samples *t*-test was used for comparison of latency of each segment of the right and left arms at 70° elbow flexion by SSNCS, and latency of each segment of the right and left arms at elbow full extension by SSNCS. Mean + 2 SD was used to define the upper limit of each segment. Then, latency of each segment in CubTS group was compared with the upper limit, and abnormal latency was judged according to it.

Latency and CMAP of the CubTS group that was in abnormal distribution were expressed as median and quartiles. Paired nonparametric test analysis was used for comparison of latency of each segment by SSNCS at 70° elbow flexion and elbow full extension, and CMAP of each segment by SSNCS at 70° elbow flexion and elbow full extension. Bivariate correlation and Bland–Altman were used to test the consistency of latency of each pair segment by SSNCS at 70° elbow flexion and elbow full extension, and CMAP of each segment by SSNCS at 70° elbow flexion and elbow full extension. The Chi-squared test was used to test the significance of abnormality of each pair segment at 70° elbow flexion and elbow full extension. A value of $P < 0.05$ was considered statistically significant.

Results

Healthy group

Thirty healthy volunteers and sixty arms in total were performed SSNCS. The latency and CMAP of each stimulation of the bilateral ulnar nerve were recorded with the elbow at 70° elbow flexion and elbow full extension. Latencies of the left arms were compared with the right arms at 70° elbow flexion and full extension, respectively. No statistically significant differences was found between the right and left arms both at 70° elbow flexion and elbow full extension. Hence, we used these sixty ulnar nerves as control samples, and mean + 2 SD was used to define the upper limit latency of each segment at 70° elbow flexion and elbow full extension positions, respectively [Table 1]. Latency of each segment in CubTS group was compared with the upper limit, and abnormal latency was judged accordingly [Table 2].

Table 1: Mean value and upper limit of latency of each segment at 70° elbow flexion and elbow full extension in healthy group ($n = 60$)

Segment	Latency at 70° elbow flexion (ms)		Latency at elbow full extension (ms)	
	Mean ± SD	Upper limit	Mean ± SD	Upper limit
BE4-BE6	0.36 ± 0.16	0.68	0.36 ± 0.17	0.70
BE2-BE4	0.36 ± 0.18	0.72	0.30 ± 0.17	0.64
E-BE2	0.42 ± 0.14	0.70	0.41 ± 0.17	0.75
AE2-E	0.47 ± 0.16	0.79	0.55 ± 0.21	0.97
AE2-AE4	0.32 ± 0.13	0.58	0.29 ± 0.14	0.57
AE4-AE6	0.30 ± 0.12	0.54	0.27 ± 0.12	0.51

E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; SD: Standard deviation.

Table 2: The abnormality of each segment at 70° elbow flexion and elbow full extension position in CubTS group ($n = 70$)

Segment	Full extension (%)	70° flexion (%)	χ^2	P*
BE4-BE6	0.19	0.16	0.20	0.65
BE2-BE4	0.16	0.20	0.44	0.51
E-BE2	0.30	0.37	0.80	0.37
AE2-E	0.73	0.66	0.84	0.36
AE2-AE4	0.14	0.14	0	1.00
AE4-AE6	0.10	0.11	0.08	0.79

*Each pair segment of 70° flexion and full extension group was analyzed by Chi-square test, $P<0.05$ was considered statistically significant. E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; CubTS: Cubital tunnel syndrome.

Cubital tunnel syndrome group

The median and quartiles of the latency of each segment in at the 70° elbow flexion and full extension are shown in Table 3. The median and quartiles of the CMAP of each segment at the 70° elbow flexion and full extension are shown in Table 4.

Latency and CMAP of each segment at elbow 70° flexion were compared with full extension by SSNCS. Paired nonparametric test analysis was used, and no statistically significant difference

Table 3: The median and quartiles for latency of each segment at 70° elbow flexion and elbow full extension position by SSNCS in CubTS group ($n = 70$)

Segment	Median (25%, 75%) (ms)		t	P*
	Full elbow extension	70° elbow flexion		
BE4-BE6	0.46 (0.20, 0.63)	0.43 (0.20, 0.58)	0.52	0.60
BE2-BE4	0.42 (0.30, 0.62)	0.40 (0.27, 0.59)	0.21	0.83
E-BE2	0.50 (0.29, 0.88)	0.63 (0.37, 1.02)	1.76	0.08
AE2-E	1.10 (0.60, 1.44)	1.08 (0.60, 1.52)	0.05	0.97
AE2-AE4	0.30 (0.13, 0.51)	0.37 (0.18, 0.50)	0.79	0.43
AE4-AE6	0.26 (0.16, 0.40)	0.30 (0.20, 0.43)	0.98	0.34

*Each pair segment of 70° flexion and full extension group was analyzed by paired nonparametric test analysis, $P<0.05$ was considered statistically significant. E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; SSNCS: Short-segment nerve conduction study; CubTS: Cubital tunnel syndrome.

Table 4: The median and quartiles for CMAP difference of each segment at 70° elbow flexion and elbow full extension position in CubTS group ($n = 70$)

Segment	Median (mv) (25%, 75%)		t	P*
	Full extension	70° flexion		
BE4-BE6	6.30 (2.68, 10.48)	4.25 (1.99, 13.00)	0.44	0.66
BE2-BE4	4.25 (2.08, 8.85)	5.05 (2.00, 8.40)	1.22	0.23
E-BE2	4.55 (1.83, 10.05)	3.05 (1.97, 9.35)	0.07	0.95
AE2-E	6.50 (2.90, 22.00)	7.50 (2.88, 16.55)	0.41	0.68
AE2-AE4	2.85 (0.97, 7.43)	3.65 (2.23, 8.60)	0.93	0.36
AE4-AE6	2.95 (1.00, 6.85)	2.95 (1.38, 5.93)	0.73	0.47

*Each pair segment of 70° flexion and full extension group was analyzed by paired nonparametric test analysis, $P<0.05$ was considered statistically significant. E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; CAMP: Compound muscle action potential; CubTS: Cubital tunnel syndrome.

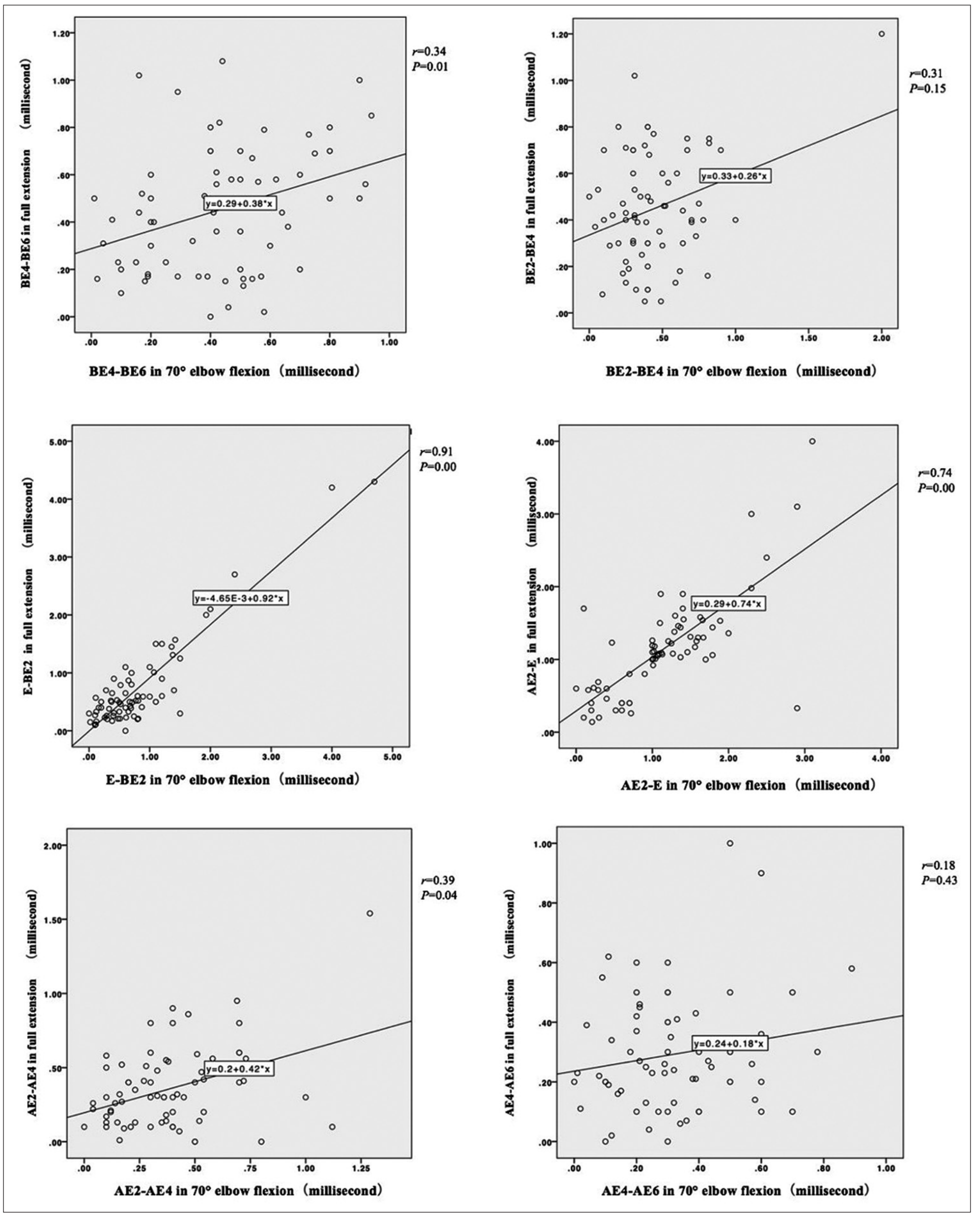

Figure 1: Correlation of latency of each segment at 70° of elbow flexion and elbow full extension by SSNCS in CubTS group (n = 70). E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; SSNCS: Short-segment nerve conduction study; CubTS: Cubital tunnel syndrome.

was found in either latency or CMAP of each segment between the elbow full extension and 70° elbow flexion position ($P > 0.05$, respectively) [Tables 3 and 4]. Bivariate correlations were used to test the consistency of latency of each paired segment at 70° elbow flexion and full elbow extension by SSNCS, except segments of BE2-BE4 ($P = 0.15$) and AE4-AE6 ($P = 0.43$) all segments were significantly correlated ($P < 0.05$, respectively) [Figure 1]. Moreover, bivariate correlations were used to test the consistency of CMAP of each segment at 70° elbow flexion and elbow full extension position, all segments were revealed strong direct associations ($P < 0.05$, respectively), except segment of BE2-BE4 ($P = 0.06$) [Figure 2]. Especially in segments across the E, 2 cm below it and 2 cm above it (E-BE2 and AE2-E), latency of these two segments at elbow full extension and 70° flexion were strong direct associated ($r = 0.91$, $P < 0.01$; $r = 0.74$, $P < 0.01$), and so did the CMAP ($r = 0.70$, $P < 0.01$; $r = 0.85$, $P < 0.01$). These two segments were also the most vulnerable locations of CubTS, which were very important in diagnosis of CubTS. Bland-Altman analysis revealed the consistency of elbow position at full extension and at 70º flexion, but the utmost difference of latency and CMAP of two methods could be 0.5 ms and 20 mv, respectively, which could not be accepted in clinical use. Hence, the results of these two positions could not substitute with each other in clinical use [Figures 3 and 4]. Each segment abnormality was calculated. Abnormality of each segment at full extension was compared with that at 70° flexion as measured by SSNCS and

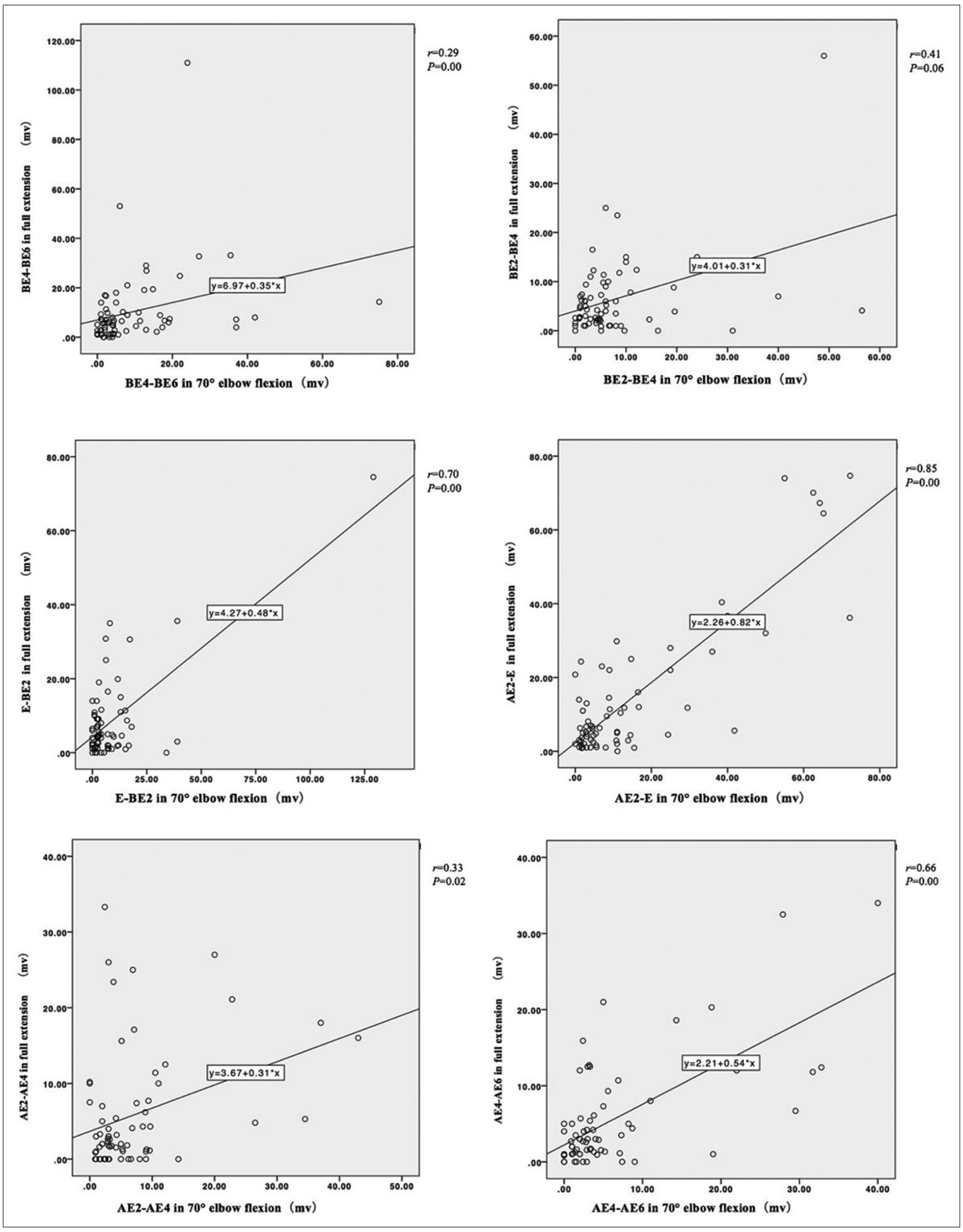

Figure 2: Correlation of CMAP of each segment at 70° of elbow flexion and elbow full extension position by SSNCS in CubTS group ($n = 70$). E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; CAMP: Compound muscle action potential; SSNCS: Short-segment nerve conduction study; CubTS: Cubital tunnel syndrome.

analyzed by the Chi-squared test, no statistically significant differences were found ($P > 0.05$, respectively) [Table 2]. In addition, data which were from segments more than 4 cm distal to the midpoint of the line between the medial epicondyle of humerus and the apex of olecranon were found to be dispersed in the scatter diagrams, suggesting instability and inaccuracy [Figures 1 and 2].

Discussion

In this study, we found no statistically significant differences in latency and CMAP taken with the patient's elbow at full extension compared with 70° flexion during SSNCS. There was also no significant difference in abnormalities detected by SSNCS while the elbow was at full extension compared with 70° flexion. In addition, the result of latency and CMAP of each segment with elbow at full extension were correlated with that at 70° flexion by SSNCS. Maintaining the patient's elbow at full extension or 70° flexion during SSNCS made no difference in diagnosis of CubTS.

SSNCS are now widely used for diagnosis and prognosis of CubTS, and our previous studies have proved its sensitivity and accuracy.[1,2,5] However, technical problems reduced the credibility of SSNCS, some reports said flexed elbow would add technique error in NCS while others vice versa. Kim *et al*.[3] reported that false positives in SSNCS were mainly caused by ulnar nerve displacement due to elbow flexion.

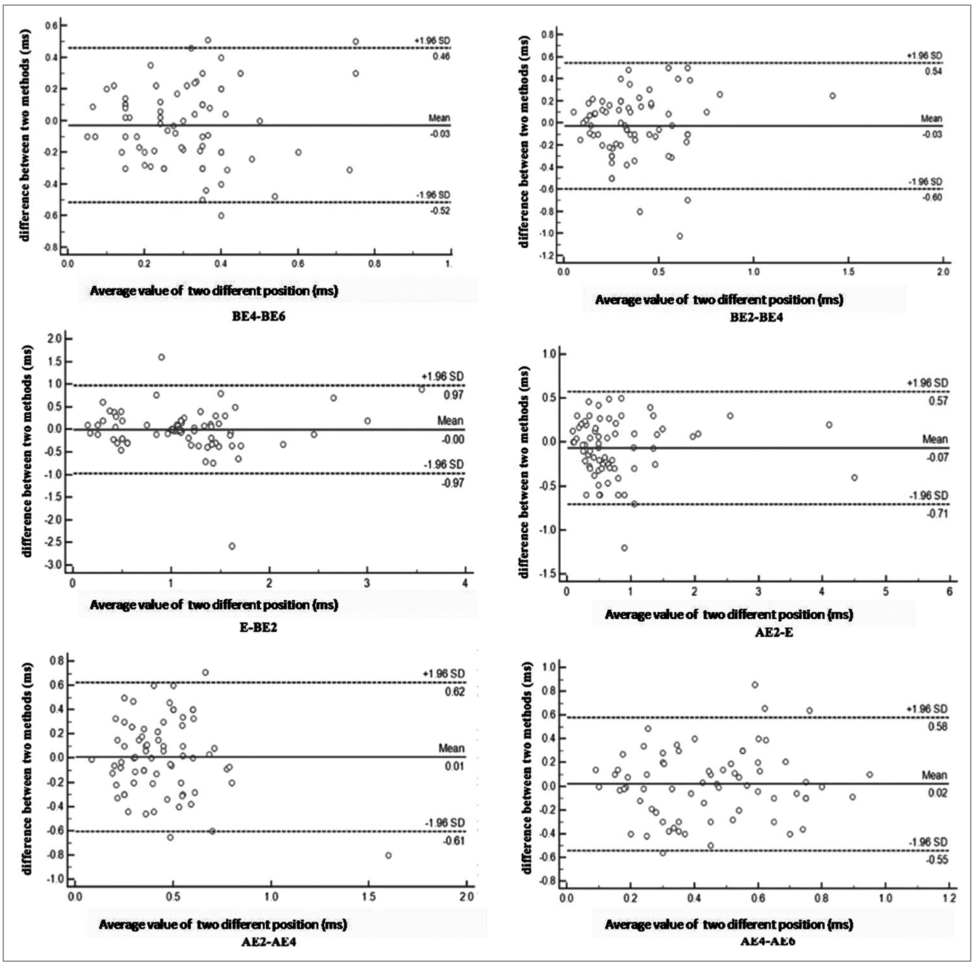

Figure 3: Bland–Altman analysis of latency at 70° elbow flexion and elbow full extension for each segment in CubTS group ($n = 70$). E: The midpoint of the line between the medial epicondyle of humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; SD: Standard deviation; CubTS: Cubital tunnel syndrome; ms: millisecond.

Ulnar nerve conduction velocity across the elbow (BE2-AE2) was reported overestimated by approximately 5.33 ± 2.29 m/s in the ulnar nerve displacement group.[6] The cause of this inaccuracy was that the elbow flexion position could potentially lead to nerve dislocation. Koo *et al*.[7] reported that elbow flexed at 135° or 90° might not be optimal because of the possibility of a hypermobile ulnar nerve at the elbow. Furthermore, this had been recently reemphasized by high-resolution ultrasonography.[3,6] Flexion also can cause increasing strain of the ulnar nerve, making the length of the nerve inaccurate.[8] On the other hand, the ulnar nerve is slack when the elbow is fully extended and may cause an inaccurate length of the ulnar nerve by surface measurement.[4] At this position, the length will be measured less than the truth, causing an artificially slow conduction velocity, misleading the diagnosis of CubTS. Checkles *et al*.[9] reported that compared with the forearm segment, the velocity of the segment across the elbow was 1.5% faster when the elbow was flexed, and 20% slower when the elbow was extended, the variation of the across-elbow velocity with the elbow fully extended was much greater than that with the elbow flexed. To solve this paradoxical problem, two studies had investigated the influence of elbow position in sensitivity of CubTS diagnosis by NCS but drew different conclusions. Bielawski and Hallett[10] found no significant difference in diagnosis CubTS between flexion and extension position of the elbow by NCS. In contrast, Kothari and Preston[11] found that elbow flexion was more sensitive than the full extension in diagnosis of CubTS, but in this experiment, they only used NCS as a criteria to diagnose CubTS.

In the present study, we found no statistically significant difference in latency and CMAP between full elbow extension and 70° elbow flexion as measured by SSNCS. There was also no statistically significant difference in abnormality and diagnosis of CubTS between full elbow extension and 70° elbow flexion as measured by SSNCS. This result was consistent with Bielawski and Hallett's findings in routine NCS.[10] Although mild elbow flexion accorded with the true length of the ulnar nerve better, this discrepancy was slight and might not be detected by neural electrophysiological tests such as SSNCS. Campbell[12] dissected 29 cadaver elbows and found that the ulnar nerve migrates distally a maximum of

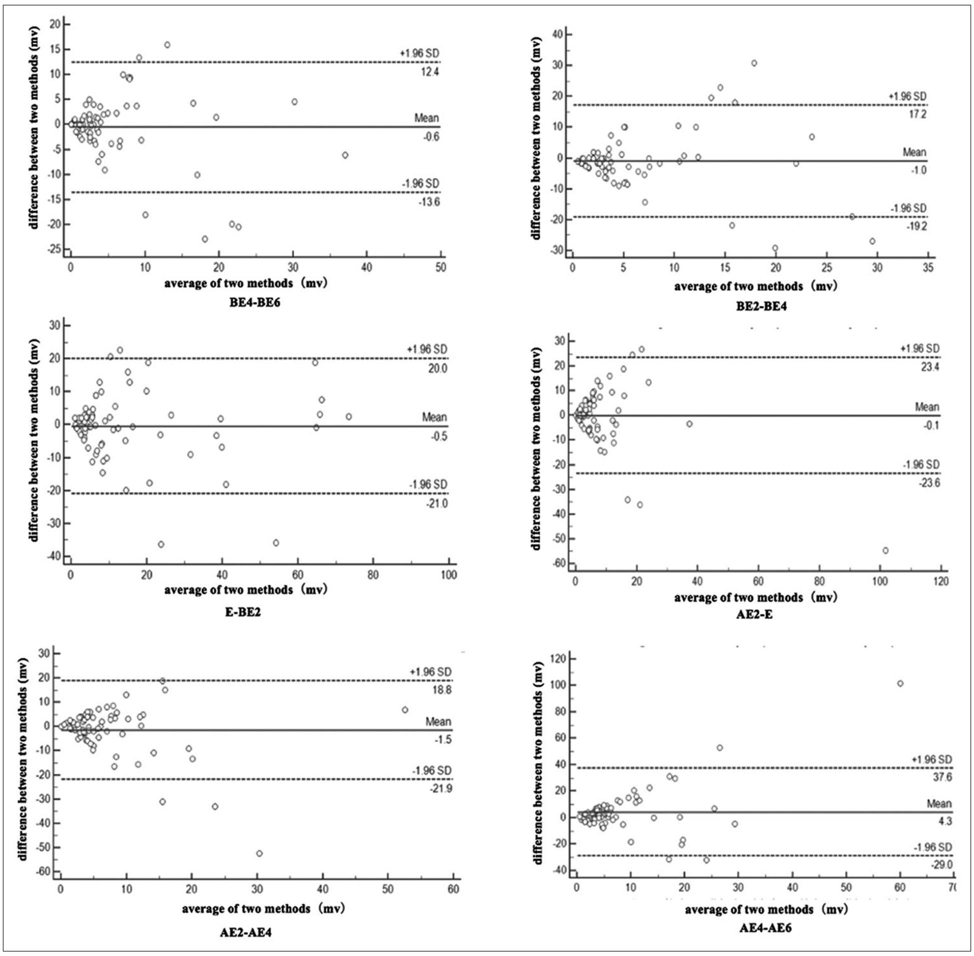

Figure 4: Bland–Altman analysis of CMAP at 70° elbow flexion and elbow full extension for each segment in CubTS group ($n = 70$). E: The midpoint of the line between the medial epicondyle of Humerus and the apex of olecranon; BE6: 6 cm below midpoint; BE4: 4 cm below midpoint; BE2: 2 cm below midpoint; AE2: 2 cm above midpoint; AE4: 4 cm above midpoint; AE6: 6 cm above midpoint; SD: Standard deviation; CAMP: Compound muscle action potential; CubTS: Cubital tunnel syndrome; SD: Standard deviation.

1.4 cm at the most extreme flexion. In mild-moderate flexion, length divergence may be even less and would be therefore harder to discover through neural electrophysiological tests. Otherwise, the ulnar nerve is sometimes hypermobile and may cause dislocation when the elbow is flexed and decrease the sensitivity of routine NCS and SSNCS. Jacobson and Jebson[13] reported displacement of the ulnar nerve at the postcondylar groove when the elbow was flexed. Kim *et al*.[5] found that ulnar nerve displacement occurred in 24.3% of 78 elbows, approximately 20.5% of these were subluxation, and 3.8% were dislocation.

In addition, we noticed that elbow flexion could potentially cause distance measurement error. Elbow flexion increased the difficulty for SSNCS investigators to fix the angle of the elbow and keep all the subjects in the same position. In addition, the 2 cm intervals had to be remarked in the flexion position, which added the difficulty of measurement. Having the patient's elbow flexed in 70° accurately was not convenient for clinical use. During SSNCS, distances were shorter than routine NCS, which was tested in 10 cm intervals and potentially had the greater influence of distance measurement error.

In our study, maintaining the patient's elbow in full extension or 70° flexion made no statistically significant difference in diagnosis of CubTS, and results were highly correlated across the elbow where most CubTS occurred. Having the patient's elbow at 70° flexion may increase measurement error and inconvenience for SSNCS investigators, so we suggest that maintain the patient's elbow in full extension during SSNCS testing can also be used in diagnosing CubTS.

In addition, as showed in the scatter diagrams, data from segments that were more than 4 cm distal to the medial epicondyle of humerus were dispersed [Figure 1 and 2] indicating that data of segments that were more than 4 cm distal to the medial epicondyle of humerus were not stable and might be not reliable. This supports the American Association of Electrodiagnostic Medicine's recommendation that stimulation at positions more than 3 cm distal to the medial epicondyle of humerus should be avoided as the nerve is usually deep within the flexor carpi ulnaris muscle by this point, and there is substantial risk of submaximal stimulation.[4] We suggest that results from 4 cm below the medial epicondyle of humerus should be used cautiously to diagnose CubTS.

In conclusion, there was no statistically significant difference in diagnosis of CubTS by SSNCS with the patient's elbow in full extension compared with the elbow in 70° flexion. Hence, we suggest positioning the elbow in full extension during SSNCS can also be used. In addition, results measured 4 cm distal to the midpoint of the line between the medial epicondyle of humerus and the apex of olecranon should be cautiously used to diagnose CubTS.

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Conflicts of interest

There are no conflicts of interest.

References

1. Jia ZR, Liu Z, Wang TT, Shi X, Liang W. Application of short-segment nerve conduction studies in the cubital tunnel syndrome. Chin J Neurol 2014;6:403-7. doi: 10.3760/cma.j.issn.1006-7876.2014.06.011.
2. Liu Z, Jia ZR, Wang TT, Shi X, Liang W. Preliminary study on the lesion location and prognosis of cubital tunnel syndrome by motor nerve conduction studies. Chin Med J 2015;128:1165-70. doi: 10.4103/0366-6999.156100.
3. Kim BJ, Koh SB, Park KW, Kim SJ, Yoon JS. Pearls & Oy-sters: False positives in short-segment nerve conduction studies due to ulnar nerve dislocation. Neurology 2008;70:e9-13. doi: 10.1212/01.wnl.0000297515.86197.2e.
4. American Association of Electrodiagnostic Medicine, Campbell WW. Guidelines in electrodiagnostic medicine. Practice parameter for electrodiagnostic studies in ulnar neuropathy at the elbow. Muscle Nerve Suppl 1999;8:S171-205. doi: 10.1002/(SICI)1097-4598 (199903) 22:3<408:AID-MUS16>3.0.CO;2-7.
5. Jia ZR, Shi X, Sun XR. Pathogenesis and electrodiagnosis of cubital tunnel syndrome. Chin Med J 2004;117:1313-6. doi: 10.3760/j.issn:0366-6999.2004.09.007.
6. Kim BJ, Date ES, Lee SH, Yoon JS, Hur SY, Kim SJ. Distance measure error induced by displacement of the ulnar nerve when the elbow is flexed. Arch Phys Med Rehabil 2005;86:809-12. doi: 10.1016/j.apmr.2004.08.006.
7. Koo YS, Cho CS, Kim BJ. Pitfalls in using electrophysiological studies to diagnose neuromuscular disorders. J Clin Neurol 2012;8:1-14. doi: 10.3988/jcn.2012.8.1.1.
8. Mahan MA, Vaz KM, Weingarten D, Brown JM, Shah SB. Altered ulnar nerve kinematic behavior in a cadaver model of entrapment. Neurosurgery 2015;76:747-55. doi: 10.1227/NEU.0000000000000705.
9. Checkles NS, Russakov AD, Piero DL. Ulnar nerve conduction velocity – Effect of elbow position on measurement. Arch Phys Med Rehabil 1971;52:362-5.
10. Bielawski M, Hallett M. Position of the elbow in determination of abnormal motor conduction of the ulnar nerve across the elbow. Muscle Nerve 1989;12:803-9. doi: 10.1002/mus.880121004.
11. Kothari MJ, Preston DC. Comparison of the flexed and extended elbow positions in localizing ulnar neuropathy at the elbow. Muscle Nerve 1995;18:336-40. doi: 10.1002/mus.880180312.
12. Campbell WW. Ulnar neuropathy at the elbow. Muscle Nerve 2000;23:450-2. doi: 10.1002/(SICI)1097-4598(200004)23:4<450:AID-MUS2>3.0.CO;2-#.
13. Jacobson JA, Jebson PJ, Jeffers AW, Fessell DP, Hayes CW. Ulnar nerve dislocation and snapping triceps syndrome: Diagnosis with dynamic sonography – Report of three cases. Radiology 2001;220:601-5. doi: 10.1148/radiol.2202001723.