ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Original Article

Upper Limbs NCV study in Users of Hand Held Vibrating Tools

Dr. Miss.SanjivaniM.Autade[1*], Dr. SrirangN. Patil[2], Dr. Vikas Satre[3]

[1]M.D. (Physiology) student, [2]Professor, Department of Physiology, Krishna Institute of Medical Sciences, 3Associate Professor, Department of Orthopedics, Krishna Institute of Medical Sciences, Karad, Krishna VishwaVidyapeeth Deemed to be University(Formerly, Krishna Institute of Medical Sciences Deemed to be University), Karad,* **Maharashtra, India, 415 539.**

Corresponding author: Dr. Miss. Sanjivani M. Autade M.D. (Physiology) student
Krishna VishwaVidyapeeth Deemed to be University(Formerly, Krishna
Institute of Medical Sciences Deemed to be University),Karad,
Maharashtra, India, Mob. +91 80104 63313,
Mail ID:deshmukhsatre@gmail.com

ABSTRACT:

Background: In the present world due to technological advancement many industrial instruments are being invented now and then to reduce the manual labour. The substantial changes have occurred in the in the pattern of working in the construction sector. The cutting instruments that are being used include chainsaws, hand drills, rock drills, and hand-held tampers.The use of various hand held vibrating tools is associated witheither HAVS, carpel tunnel syndrome (CTS) or both.

Material & methods: In the present study 40 Construction workers using drill machines (concrete brokers & steel brokers) & 40 Controls (not exposed to hand vibration) were selected and Nerve conduction study (NCS) of both upper limbs was carried out. Motor & sensory nerve conduction of Ulnar, Median & Radial nerves was studied. Results of both the groups were compared.

Results: The Distal Motor Latency (Min.) of Right Median, Right Radial & Right Ulnar was significantly prolonged in workers compared to control Group ($p < 0.05$).The Amplitude of CMAP of Right Median & Right Radial was significantly reduced in workers compared to control Group ($p < 0.05$).Motor conduction velocities of Right Ulnar, Right Median, Right Radial, Left Median & Left Ulnar were significantly reduced in workers compared to control Group ($p > 0.05$).

Conclusion: From our study we conclude that the long term repetitive exposure to hand vibration is associated with distal neuropathy more of sensory than motor. The median nerve is mostly affected but in few cases there is also involvement of radial nerve. Dominant hand is affected most of the time. However in few cases there is bilateral involvement.

Key words: Construction workers, Hand-vibration, NCV, Nerve conduction.

Introduction:

In the present world use of technology is has entered in each and every field. There is fast mechanisation in the modern era. The industrialization, urbanisation, and infrastructure development have all been mechanised. Many industrial instruments are being invented now and then to reduce the manual labour. The reasons for this include shortage of workforce, saving of time and money. The substantial changes have occurred in the in the pattern of working in the construction sector. The construction of buildings needs a huge amounts of cutting wood, timber, and concrete into various forms and sizes to fit into buildings, particularly prefabricated constructions. The cutting instruments that are being used include chainsaws, hand drills, rock drills, and hand-held tampers.

The use of various hand held vibrating tools is associated with hand -arm vibration syndrome (HAVS). Symptoms of this syndrome are tingling, numbness, loss of grip strength and pain. There may be damage to the vascular, neurological & musculoskeletal systems of the upper limbs due to vibration of these tools. The manifestation of which will be either HAVS, carpel tunnel syndrome (CTS) or both (1). A number of factors are related to increased risk of HAVS. These factors are individual worker acceptability, the frequency, duration and amplitude of exposure(2).

Nerve conduction studies (NCS) provide objective and quantitative assessment of peripheral nerve function. Neurologists have considered these studies as the gold standard for assessing peripheral nerve damage (5). In a prospective study of industrial workers it was reported that work place factors including managing vibrating tools appeared to have a certain relationship to CTS (6). Another study reported that significant differences in digital sensory conduction velocities between vibration – exposed & non-exposed workers were illuminated after systemic warming (7). This shows lack of consistency which may be due to sparsity of published longitudinal etiological study for better understanding of exposure -responsive relationship. It would be desirable to have longitudinal study design, to obtain a more accurate exposure assessment. So this study is planned to assess the function of upper limb nerves in construction workers using vibrating hand tools.This will help in comparing effects of various hand – held vibrating tools and find correlation between duration of exposure & severity of peripheral neuropathy.

Material & Methods:

AIM: The aim of present retrospective study is to assess effects of hand held vibrating tools on nerves of upper limb.

OBJECTIVES:

1) Tocarry out the NCV investigation of upper limb nerves in vibrating tool user group
2) To carry out the NCV investigation of upper limb nerves in control group
3) To compare the NCV findings of study group with those of control group.
4) To study the specific association between duration of exposure to hand held Vibration and severity of distal neuropathy in hand

Study design: Analytical cross sectional study

Study subjects: 1) Construction workers using drill machines (concrete brokers & steel brokers)

2) Control group workers

Inclusion criteria:-

1) Male workers using hand held vibrating tools with age between 20 to 60 years
2) Persons working with hand held vibrating tools at list for 1 year
3) Persons doing office work not subjected to use of hand held vibrating tools as controls

Exclusion criteria:

1) Persons suffering from chronic diseases like diabetes causing peripheral neuropathy .patients suffering from cervical radiculopathy, rheumatoid arthritis, peripheral nerve trauma.
2) Persons operated for carpel tunnel syndrome.

Data collection:

Primary data e.g.name, age, sex, height in cms and weight in Kg was noted of each person in subject group and control group. History of any previous major disease was asked and then general & systemic examination of CNS was carried out. The vibration exposure history was noted. The subjects were divided into four groups depending on duration of exposure-Group A(<5 yrs of exposure), Group B(5-10 yrs), Group C(10-15 yrs), and Group D(>15 yrs).The NCS was carried by using standard method as described in book on clinical neurophysiology (8). Nerve conduction study was conducted on nerves of upper limb on both sides. Data was collected for ulnar nerve, median nerve & radial nerve.

Following NCS parameters were measured.

1) Motor nerve conduction – Amplitude at wrist, latency at wrist, latency at elbow, MNCV (Motor nerve conduction velocity)

2) F –wave latency.

3) Sensory nerve conduction ---Latency at wrist,latency at elbow, amplitude at wrist & SNCV (Sensory nerve conduction velocity).

(SNAP) at wrist, (Minimum latency) & SNCV (Sensory nerve conduction velocity)

MOTOR CONDUCTION:

Recording electrodes were applied at appropriate position for particular nerve. Nerve wasstimulated by stimulating electrodes at two different places (Distally at wrist/forearm for radial nerve & proximally at cubital fossa or spiral groove for radial nerve). The suprathreshold strength of stimulus was used. The response in the form of CMAP was recorded. The markers for beginning/end of response and peaks of CMAP were adjusted appropriately. The distance between two points of stimulation was measured with measuring tape and entered incomputer. The automatic calculation of velocity and amplitude of CMAP and other parameters were done by computer and were noted.

SENSORY CONDUCTION;

Recording electrodes were applied at appropriate position for particular nerve. Nerve wasstimulated by stimulating electrodes at index/little finger/forearm for radial nerve. Orthodromic sensory conduction was studied. The suprathreshold strength of stimulus was used. The response in the form of SNAP was recorded. The markers for beginning/end of response and peaks of SNAP were adjusted appropriately. The distance between stimulating and recording active electrodes was measured with measuring tape and entered in computer. The automatic calculation of velocity and amplitude of SNAP and other parameters were done by computer and were noted.

F-WAVE RESPONSE:

The arrangement of electrodes for recording F-wave response was similar to motor nerve conducting except position of stimulating active & indifferent electrodes was exchanged.Starting from minimal stimulus strength gradual increased strength stimuli

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

were given to the nerve until 10 responses were recorded. The markers were adjusted to mark beginning of M-response and minimal and maximal latencies of F-wave response.

STATISTICAL ANALYSIS:

Data was entered using Microsoft Excel 2010 for windows. Summarization and analysis of data was carried out by using Software Statistical Package for Social Sciences (SPSS version 20) Statistics like Mean &standard deviation was calculated. In order to test the significance of the difference, statistical test-unpaired t test was used. The difference was said to be significant if the p value was <0.05.

Results:

It is seen from Table 1 that control Group and Subject Groups were age matched ($p> 0.05$), also there was no significant difference of Height and weight in both Groups ($p > 0.05$).

Table 2 shows that the Distal Motor Latency (Min.) of Right Median, Right Radial & Right Ulnar was significantly prolonged in construction workers compared to control Group ($p <0.05$).

Distal motor latency of all three nerves on Lt. sidewas prolonged in construction workers but the difference was not statistically significant.

The Amplitude of CMAP of Right Median & Right Radial was significantly reduced in workers compared to control Group ($p < 0.05$).

The Amplitude of CMAP of both Ulnar and left Radial was also reduced in workers compared to control Groupbut not to the statistically significant level ($p > 0.05$).

Motor conduction velocity of Right Ulnar, Right Median, Right Radial, Left Median & Left Ulnar were significantly reduced in workers compared to control Group ($p>0.05$).

Motor Conduction Velocity of left Radial was reduced in workers compared to Control Group but not to the statistically significant level

From Table 3, it is seen that the Distal Sensory Latencies of Left Ulnar,both median and Right Radial were significantly prolonged in construction workers compared to Control Group ($p< 0.05$). The Distal Motor Latencies of Right Ulnar and Left Radial were also prolonged in workers compared to Control Group but not to the statistically significant level.

The Amplitudes of SNAPs of Right Ulnar, both Median and both Radial were significantly reduced in workers compared to Control Group ($p < 0.05$). The

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Amplitudes of SNAP of Left Ulnar was also reduced in workers but to statistically significant level.Sensory Conduction Velocities of both Ulnar, both Median and both Radial were significantly reduced in workers compared to Control Group ($p > 0.05$).

From table 4, it is seen that distal motor latencies were gradually prolonged of Rt. Ulnar & both Median as the duration of exposure was increased, but not to the statistically significant level. The amplitudes of CMAPs were also gradually reduced of both median nerves as the duration of exposure was increased > 10 years.

From table 5, it is seen that distal sensory latencies were gradually prolonged of both Median as the duration of exposure was increased, but not to the statistically significant level.The amplitudes of SNAPs were also gradually reduced of both median, Rt. Ulnar & Lt. Radial nerves as the duration of exposure was increased > 10 years.

From table 6, it is seen that F-wave minimum latencies of both Median were significantly prolonged in workers compared to control group.

Discussion:

In many occupations hand-held vibrationtools are being used commonly. A variety of symptoms are produced after repetitive exposure to vibration. This is known as the hand-arm vibration syndrome (HAVS), an occupationally induced neurovascular syndrome. The symptoms include digital vasospasm (vibration white finger), sensorineural disturbances and/ or muscular weakness and fatigue (9). This syndrome results due to continued use of vibrating tools (oscillation rate between 20 and 1000 Hz (10). HAVS is many times unrecognized hazard of use of vibrating tools as many workers discover the illness after many years of using the tools. It is not much apparent as other occupational hazards e.g. exposure to toxic chemicals or fumes (11).

The pathophysiology that is responsible for development of HAVS includes sympathetic hyperactivity, changes in alpha-adrenergic receptor mechanisms, deficient function of endothelial-derived relaxing factor, nitric oxide involved in abnormal vascular tone and vasodilatation, and increased levels of the cell adhesion molecule sICAM-1 inducing leucocyte adhesion including inflammatory responses (12). Animal model study shows an initial reversible damage of myelinated rat tail fibers. However, the characteristics and mechanisms of the sensorineural deficits in HAVS are not yet clearly understood (13). The main symptom indicative of HAVS is cold-induced vasospasms, loss of tactile sensitivity in finger and hand, pain, reduction in manual dexterity and grip strength, joint injuries and

Atrophy of muscle (14).

Two types of disorders in peripheral nerves may result due to vibrationtool handling. The motor impairment is the first one that ends in muscle weakness and atrophy. The second oneissensoryweaknessthatresults indecreasedsensationsoftouch,pain,vibration,temperature andpressure(15).

Many studies have done research in isolated groups using a single type of vibrating tool and have given different results. Some have got results about motor disturbances only, few only sensory disturbances, few have got combined results and few have got no any type of disturbance at all. However many studies have described isolated sensory disturbances(16).

In present study we carried out the NCV investigation in the construction workers using hand-held vibrating tools. Also we carried out NCV in age matched control group. We compared the findings of NCV between control group and subject group. The NCV study was done in the upper limb nerves -Ulnar, Median & Radial on both sides. The Motor nerve conduction(MNC), Sensory nerves conduction & F-wave response (Min. latency) studies were done.Inthestudyofliterature,thereisnostudywithsimilarassessment inthisarea. We intended to studythetypeofeffect–isolated,combinedorneither. The mean age in control group was 42.45± 9.71 and that of subjects was 39.8 ± 10.31 years. The mean height of control group was 163.45 ± 6.34 and that of subjects was 164.67 ± 6.34 cms. The mean weight of control group was 68.75 ± 11.80 and that of subjects was 66.5 ± 8.97 kgs. There was no significant difference in age, height and weight of both the groups-control & subject (p>0.05).

These results are comparable to those by Yoo et al.(17). They reported that the majority of workers with HAVs were in their 40s. The results of present study are in accordance with the Kao et al.(18) who reported that, the control group 20-50 years old(mean=38.5 years).This group consisted of persons with no history of using vibrating tools frequently. The subject group consists of construction workers, aged between 20 and 60 years (mean= 39.8 years). The history of frequent vibrating tool use varied from 1 to 30 years (mean= 10.92 years).

There was significant prolongation of distal motor latency of Ulnar, Median and Radial nerve in dominant hand in construction workers compared to control group. The amplitudes of CMAPS of Median & Radial nerve were significantly reduced in dominant hand. There was slowing of motor conduction of Median nerve in dominant hand(Rt. hand)in this group of workers. There was significant prolongation of distal sensory latency, significant decrease in SNAP amplitude and slowing of sensory conduction Median & Radial nerves in dominant hand compared to control group.

These findings are in accordance with these of Essam M. Ebrahim et al. (4), Discaizi and Per-relli (19), Hirata et al. (20) and A.A. Selimetal. (21). There was significant prolongation of distal sensory latency, significant decrease in SNAP amplitude and slowing of sensory conduction Ulnar, Median & Radial nerves in both hands compared to control group but more prominent in dominant hand for Median nerve. These findings might be due to involvement of central nervous system in vibration exposed workers (22).

The F-wave latencies of both Median were significantly prolonged in subject group compared to control. This finding is in accordance with that of Essam M. Ebrahim et al. (4).

A markeddifferencebetweenthedegreeofdelaybetweenmedianandulnarnervessensoryconduction velocity was reported by ArakietalandLukas. Themoredelaywasobservedinulnarnerveinbothhands andexplainedthatulnarnervewasmorevulnerableat theelbow,wristandhands. The Luxationwasalsopossibleatthe elbow(23,24.). A significantassociationwasobservedbetweendurationofexposuretothevibratorytoolandthe nerveconduction velocity in a study by Dr. DavidRampal. Sensoryconductioninmanysegmentsofradialandmedialnerveswereremarkablyreducedintheoperatorsofchainsawwhencomparedwithmanuallabourers.Thepattern ofdamagewasmultifocalimpairmenttoneuralsegmentsinvolving sensory component. In a study on construction workers by T Brismar& L Ekenvall it was indicated that the median nerve is most vulnerable for hand-arm vibrations. However, the conduction defects were not pronounced enough to diagnose CTS in most individual cases (25).

A digital sensory neuropathy can be produced by hand -arm vibration because of development of damage to the sensory nerve fibres and skin mechanoreceptors in the fingers. A recent meta-analysis has indicated approximately a 7 fold increased risk of digital sensory neuropathy due to hand-arm vibration exposure (meta-odds ratio: 7.37; 95% CI: 4.28 – 14.15) (26). Thenumbness and tingling in the fingers that is present even when not exposed to the cold is the manifestation of the digital sensory neuropathy. An exposure to cold may lead to digital vasospasm and transient reduction in blood supply to peripheral nerves with resultant transient numbness and tingling but these transient abnormalities do not constitute evidence of the sensorineural component of HAVS.

Exposure to ergonomic stressors, in particular repeated, forceful wrist movements and/or awkward wrist postures, is the main established risk factor for CTS. However the recent epidemiological evidence suggests that hand-arm vibration exposure is an independent risk factor for CTS. A statistically significant risk of CTS due to hand-arm vibration exposure has been found by recent meta-analyses (22, 26).The present study concludes that repetitive hand-vibrating tool use may be responsible for distal sensory and motor neuropathy. The workers were advised to wear special gloves at all time when using vibrating tools, warming of hands before starting the work job, and keep them warm during winter.

Conclusion: From our study we conclude that the long term repetitive exposure to hand vibration is associated with distal neuropathy more of sensory than motor. The median nerve is mostly affected but in few cases there is also involvement of radial nerve. Dominant hand is affected most of the time. However in few cases there is bilateral involvement. Nerve conduction study is the non-invasive test that can be used for early detection of neuropathy. We recommend that workers should follow some preventive measure such as -use of anti-vibration gloves all the time when using vibrating hand tools, warming the hands before starting the work especially in the winter. It is also important thatworkers should be made aware about early reporting of symptoms so there will be early detection of adverse effects if any and preventive measures may be taken to avoid further deterioration of the clinical condition.

Acknowledgements: We would like to thank the head of Department of Physiology for giving me permission to use departmental facilities and extending due support. We also thank the non-teaching staff in the Physiology Department for their constant support and co-operation. This work would not have been possible without the participants who have helped in data collection for the research and all of them deserve special thanks.

Conflict of interest: The authors declare that there is no any conflict of interest.

ISSN PRINT 2319 1775 Online 2320 7876
 UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Limitations: The sample size that we studied may be small to draw definitive conclusions. So a large scale study with greater sample size might be more conclusive.

References:

[1] Busi N, Chirs M, Barber and Mary Ross. Hand-arm vibration syndrome in south African Gold miners. Occupational Medicine,2007; 57:25-29

[2] Busi N, Chris M, Barber and Mary Ross. Hand-arm vibration syndrome in South African gold miners. Occupational Medicine; 2007;57: 25-29.

[3] Sanden H, Jonsson A, Wallin BJ and Burstrom L. Nerve conduction in relation to vibration exposure - a non-positive cohort study. Journal of Occupational Medicine and Toxicology;2010; 5:21-31.

[4] Essam M Ebrahim, Mohmmad E Omar, Wael Osman Mohmed, Sabry Mohamed Fathy, et. al. Electrodiagnostic studies in workers Exposed to hand-arm vibration. J Am Sci 2014; 10(11): 101-108.

[5] L Lander ,W Lou ,R House. Nerve conduction studies and current perception threshold in workers assessed for hand _arm vibration syndrome. Occupational Medicine ; 2007;Jun 57(4): 284-9

[6] Helena Sanden ,Andreasjonsson ,B Gunnar wallin .Nerve conduction in relation to vibration exposure. J Occup Med Toxicol.;2010;Jul 19;5;21.doi: 10.1186/1745-6673-5-21

[7] G Piligian, R Herbert, M Hernias, J Dropkin, P Landsbergis, M Cherniack. Evaluation and management of chronic work-related musculoskeletal disorders of the distal upper extremity. Am J IndMed ; 2000; Jan37(1): 75-93.

[8] Clinical neurophysiology. I^st Ed. U K MISRA and J KALITA. B.I .Churchill Livingstone Pvt. Ltd, New Delhi, 1999.

[9] Gerhardsson L, Burstrom L, Hagberh M and Lundstrom R. Quantitative neurosurgery findings,symptoms and signs in young vibration exposed workers. Journal of Occupational Medicine and Toxicology; 2013; 8: 8-15.

[10] Voelter-Mahlknecht, McGeoch KL, Ishal M and Dahlin L. Evaluation of work-related carpal tunnel syndrome. J Occup Rehabil.2008; 15:90-108.

[11] Occupational Health clinics for antario workers inc; 2007.Hand arm vibration syndrome.

[12] Harada N and Mahbub MH. Diagnosis of vascular injuries caused by hand-transmitted vibration. Int Arch Occup Environ Health.2008;81: 507-18.

[13] Rolke R, Rolke S, Vogt T and Birklein F. Hand-arm vibration syndrome: Clinical characteristics, conventional electro-physiology and quantitative sensory testing. Clinical Neurophysiology.2014; 124:1680-1688.

[14] Griffin MJ and Bovenzi M. The diagnosis of disorders caused by hand-transmitted vibration. Southampton Workshop 2000. Int Arch Occup Environ Health2002; 75: 1-5.

[15] OhtaY,FujimotoO,NannoH,AsaoH,FujiiH(1985)Studyofsomatosensory evoked response (SER) in patients with occupationalvibration disease (in Japanese with English abstract). Jpn J Ind Health27:318–326.GoogleScholar.

[16] PyykkoI(1986)Clinicalaspectsofthehand-armvibrationsyndrome: areview.ScandJWorkEnvironHealth12:439–447.

[17] Yoo C, Lee JH, Lee CR, Kim Y and Lee H. Occupational hand-arm vibration syndrome in Korea. Int Arch Occup Environ Health; 2005;78: 363-368.

[18] Kao DS, Yan JS, Zhang LL, and Kaplan RE. Serological Tests for Diagnosis and Staging of hand-arm vibration syndrome (HAVS). Hand 2008; 3:129-134.

[19] Discalzi G. and G. Perrelli, Use of somato-sensory evoked potentials in the exposure of the hand- arm system to localized vibrations. Med-Lav.Jan-Feb.2000; 81(1): 50-3.

[20] Hirata M., H. Sakakibara, M. Abe. Reduced sensory nerve conduction velocity of the distal part of the radial nerve among patients with vibration syndrome. ElectromyogrClinNeurophysiol Mar 2002;42(2): 113-8.

[21] Selim AA, Sobh Khaled and Sabry M Fathy. Hand-arm vibration syndrome Clinical and Neuro- physiological studies. Australian Journal of Basic and Applied Sciences.2012; 6(6): 292-299.

[22] Hirata M., T. Matsumoto, N. Toibane, T. Hashinguche et al. Involvement of the central nervous system in vibration syndrome. Int Arch Occup Environ Health 1995; 67(3): 173-78.

[23] Araki S., Honma T. Aoyamak. Sahgyoigaku. Japnese Journal of Industrial Health. 01 Nov.1976;18(6): 516-520.

[24] Stockard JJ, Stockard JE, Sharbrough FW (1986) Brainstem auditory evoked potentials in neurology: methodology, interpretation, and clinicalapplication.In:AminoffMJ(ed. Electrodiagnosisinclinicalneurology.Churchill Livingstone,NewYork,pp.467–503.

[25] TanabeT,KamedaM(1979)Somatosensoryevokedpotentialandnerveconductionvelocityinvibrationdisease(inJapanese).ClinElectroenceph21:324–328.

[26] T. Brismar, L. Ekenvall. Nerve Conduction in the hands of vibration exposed workers. ElectroencephalogrClin Neurophysiol.Jun.1992; 85(2): 173-6.

Table-1. Anthropometric measurements of Control & Subject groups.

Sr. No.	Control group (Mean ± SD) (N = 40)	Subject group (Mean± SD) (N = 120)	pValue
Age (yrs)	42.45± 9.71	39.8 ± 10.31	0.2404[ns]
Height (cm)	163.45 ± 6.34	164.67 ± 6.34	0.4939[ns]
Weight (Kg)	68.75 ± 11.80	66.5 ± 8.97	0.3402[ns]

ns – Statistically non-significant

Table 2. NCV findings (MNC) in Control group & groupI

Name of Nerve and NCV Parameter	Control Group (N=40) (Mean± SD)	Group I (N=40) (Mean± SD)	p Value
Right Ulnar			
Minimum Latency(ms)	2.60±0.59	2.94±0.89	0.0518

CMAP Amplitude(mV)	9.59±3.17	9.53±3.8	0.9369
MCV(m/s)	59.33±5.7	54.16±9.38	0.0039
Right Median			
Minimum Latency(ms)	3.37±1.15	4.08±1.24	0.0105
CMAP Amplitude(mV)	10.85±4.39	8.93±4.39	0.0188
MCV(m/s)	57.48±6.36	44.99±8.27	< 0.0001
Right Radial			
Minimum Latency(ms)	2.36±0.74	2.97±1.03	0.0032
CMAP Amplitude(mV)	9.07±3.04	7.76±2.57	0.0452
MCV(m/s)	56.30±11.46	48.48±8.83	0.0010
Left Ulnar			
Minimum Latency(ms)	2.71±0.64	2.86±0.44	0.2206
CMAP Amplitude(mV)	11.22±3.60	10.77±3.36	0.5662
MCV(m/s)	60.19±7.29	55.75±6.60	0.0055
Left Median			
Minimum Latency(ms)	3.16±0.80	3.62±1.36	0.0677
CMAP Amplitude(mV)	11.35±3.49	11.57±3.44	0.8235
MCV(m/s)	56.98±6.89	54.38±7.82	<0.0001
Left radial			
Minimum Latency(ms)	2.63±0.65	2.82±0.50	0.1445
CMAP Amplitude(mV)	8.78±2.99	8.14±2.26	0.2817
MCV(m/s)	54.40±8.48	52.79±11.36	0.3273

Table 3. NCV findings (SNC) in Control group & group I

Name of Nerve and	**Control Group**	**Group I**	**p Value**

NCV Parameter	(N=40) (Mean± SD)	(N=40) (Mean± SD)	
Right Ulnar			
Minimum Latency(ms)	2.23±0.31	2.43±1.40	0.3872
SNAP Amplitude(mV)	10.07±4.32	7.49±2.74	0.0021
SCV(m/s)	58.08±8.81	46.07±10.77	<0.0001
Right Median			
Minimum Latency(ms)	2.53±0.46	3.21±0.66	<0.0001
SNAP Amplitude(mV)	18.71±7.14	9.95±3.39	<0.0001
SCV(m/s)	58.25±7.53	47.01±4.83	<0.0001
Right Radial			
Minimum Latency(ms)	2.10±0.51	2.50±0.65	0.0032
SNAP Amplitude(mV)	24.45±9.90	18.19±8.22	0.0060
SCV(m/s)	68.09±11.47	55.77±13.07	<0.0001
Left Ulnar			
Minimum Latency(ms)	2.17±0.35	2.58±0.49	<0.0001
SNAP Amplitude(mV)	13.05±5.30	11.48±6.52	0.2387
SCV(m/s)	60.40±10.66	48.99±9.44	<0.0001
Left Median			
Minimum Latency(ms)	2.54±0.41	2.81±0.73	0.0494
SNAP Amplitude(mV)	22.98±7.83	14.16±6.17	<0.0001
SCV(m/s)	56.88±9.77	46.61±8.48	<0.0001
Left radial			
Minimum Latency(ms)	2.22±0.46	2.42±1.17	0.3146
SNAP Amplitude(mV)	18.21±6.44	13.18±5.09	0.0002
SCV(m/s)	60.56±7.73	57.12±8.52	0.0620

Table 4. NCV findings (MNC) in subgroups of Construction workers

Name of Nerve and NCV Parameter	Group A (N=06) (Mean± SD)	Group B (N=15) (Mean± SD)	Group C (N=14) (Mean±SD)	Group D (N=05) (Mean±SD)	p Value
Right Ulnar					
Minimum Latency(ms)	3.40 ± 0.81	2.76 ± 0.73	2.73 ± 0.55	3.5 ± 1.75	0.1783
CMAP Amplitude(mV)	5.73 ± 3.0	8.88 ± 3.67	11.7 ± 3.03	10.32 ± 4.03	0.0093
MCV(m/s)	47.4 ± 9.36	52.26 ± 4.89	57.66 ± 10.64	56.46 ±±9.4	0.0977
Right Median					
Minimum Latency(ms)	3.36 ±0.25	3.96 ±1.09	4.35 ± 1.39	4.72 ± 1.95	0.2901
CMAP Amplitude(mV)	8.39 ± 1.01	9.37 ±2.7	9.28 ±± 2.72	7.29 ±2.27	0.3778
MCV(m/s)	51.02 ±13.48	52.44 ± 4.98	49.17 ± 9.09	43.72 ± 2.98	0.2222
Right Radial					
Minimum Latency(ms)	3.56 ± 1.22	3.21 ±0.99	2.49 ±0.76	2.87 ± 1.27	0.1138
CMAP Amplitude(mV)	9.14 ± 1.83	7.53 ± 2.24	7.27 ± 3.39	8.17 ±1.20	0.4977
MCV(m/s)	52.2 ± 9.14	47.02 ± 9.34	48.96 ±8.03	47.07 ±10.43	0.6662
Left Ulnar					

IJFANS International Journal of Food And Nutritional Sciences
Official Publication of International Association of Food and Nutrition Scientists

Minimum Latency(ms)	2.60 ± 0.45	3.03 ± 0.53	2.8 ± 0.32	2.85 ± 0.23	0.1962
CMAP Amplitude(mV)	9.68 ± 1.34	10.28 ± 3.32	11.75 ± 3.75	10.83 ± 4.16	0.5623
MCV(m/s)	52.78 ± 5.56	55.87 ± 4.82	55.30 ± 8.64	60.21 ± 4.81	0.3219
Left Median					
Minimum Latency(ms)	3.33 ± 0.38	3.47 ± 0.45	3.85 ± 2.25	3.80 ± 0.54	0.8307
CMAP Amplitude(mV)	10.61 ± 4.33	12.35 ± 2.76	11.02 ± 3.81	8.73 ± 2.17	0.2195
MCV(m/s)	59.98 ± 6.52	51.65 ± 4.62	54.84 ± 10.46	54.54 ± 6.07	0.1756
Left radial					
Minimum Latency(ms)	2.83 ± 0.77	2.97 ± 0.30	2.73 ± 0.51	2.60 ± 0.60	0.4313
CMAP Amplitude(mV)	7.79 ± 2.95	7.74 ± 2.01	8.81 ± 2.22	7.84 ± 2.54	0.6020
MCV(m/s)	57.30 ± 13.10	49.95 ± 10.81	55.5 ± 10.11	43.51 ±10.53	0.1124

Table 5. NCV findings (SNC) in subgroups of Construction workers

Name of Nerve and NCV Parameter	**Group A (N=06) (Mean± SD)**	**Group B (N=15) (Mean± SD)**	**Group C (N=14) (Mean±SD)**	**Group D (N=05) (Mean±SD)**	**p Value**
Right Ulnar					
Minimum Latency(ms)	2.35 ± 0.56	2.38 ± 0.50	1.94 ± 0.77	2.72 ± 0.61	0.100
SNAP Amplitude(mV)	7.53 ± 2.54	8.33 ± 2.71	7.21 ± 3.26	7.02 ± 1.47	0.7113
SCV(m/s)	49.79 ± 6.34	51.03 ± 9.63	41.65±12.50	39.09 ±2.66	0.0324

Right Median					
Minimum Latency(ms)	2.53 ± 0.39	3.15 ± 0.53	3.38 ± 0.51	3.92 ± 0.91	0.0023
SNAP Amplitude(mV)	8.29 ± 2.12	12.96 ± 3.39	8.95 ± 3.03	5.7 ±2.95	0.0001
SCV(m/s)	51.93 ± 5.75	47.84 ± 4.02	46.72 ± 4.62	43.51 ±4.52	0.0308
Right Radial					
Minimum Latency(ms)	2.31 ±0.72	2.67 ± 0.70	2.41 ± 0.62	2.45 ± 0.58	0.6236
SNAP Amplitude(mV)	15.53 ± 7.27	19.32 ± 9.15	19.55 ± 8.19	14.22 ±6.39	0.4975
SCV(m/s)	60.62±17.30	53.53 ±0.96	56.79±16.46	53.97 ±8.29	0.7179
Left Ulnar					
Minimum Latency(ms)	2.63 ± 0.52	2.59 ± 0.30	2.49 ± 0.46	2.75 ± 0.97	0.7912
SNAP Amplitude(mV)	10.23 ±4.76	11.96 ± 5.64	11.28 ±5.58	14.62 ±12.23	0.7312
SCV(m/s)	47.91 ±4.56	47.58 ± 6.28	52.19±12.37	45.52 ±12.19	0.4562
Left Median					
Minimum Latency(ms)	2.46 ± 0.40	2.97 ± 0.26	2.72 ± 0.50	3.01 ±1.86	0.4587
SNAP Amplitude(mV)	15.41 ±7.46	13.96 ± 3.61	14.19 ± 6.56	11.36 ±7.37	0.7246
SCV(m/s)	49.77 ±6.02	45.45 ± 4.01	46.11 ± 6.04	47.70 ±21.40	0.7560
Left radial					
Minimum Latency(ms)	2.37 ± 0.72	2.31 ± 0.69	2.16 ± 0.65	3.54 ± 2.78	0.1432
SNAP Amplitude(mV)	13.91 ± 7.03	14.96 ± 3.36	12.75 ±4.92	10.4 ± 6.17	0.3550
SCV(m/s)	53.09 ±4.82	58.66 ± 6.64	58.89 ±10.64	52.36 ±9.19	0.2673

Table 6: F-wave latency in Control & Subject group

Name of nerve	**F-wave latency (ms) in Control group Mean ± SD**	**F-wave latency (ms) Subject group Mean ± SD**	**p Value**
Lt. Ulnar	23.32 ± 2.56	24.24 ± 2.61	0.1166
Rt. Ulnar	24.75 ± 2.65	24.45 ± 2.66	0.6109
Lt. Median	23.43 ± 2.60	24.68 ± 2.63	0.0362
Rt. Median	24.16 ± 2.37	25.40 ± 2.82	0.0360