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A COMPARATIVE STUDY TO ASSESS THE CHANGES IN THE CONDUCTION OF MEDIAN NERVE AT WRIST JOINT IN APPARENTLY ASYMPTOMATIC COMPUTER USERS WITH THAT IN GENERAL POPULATION

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ABSTRACT

Background: Nerve Conduction Testing is frequently used by the physiotherapist as an investigation procedure for Carpal Tunnel Syndrome. Carpal Tunnel Syndrome may develop in Computer users as well as in General Population those who are using their wrist and finger frequently. **Objectives:** To compare the Nerve Conduction changes amongst the two groups of people; those working on computer and general population who are involved in cooking, masoning, sweeping etc. **Methods**: 60 individuals were divided into 2 groups, group A and group B consisting of 30 individuals each. Group A: Individuals without any symptoms of Carpal Tunnel Syndrome working for $\geq$ 4 hours per day for $\geq$ 1 year. Group B: Individuals belonging to general population not using computer. Analysis was based on the distal motor latency and sensory nerve action potential taken for the dominant hand. **Results:** Mean±SD for Distal Motor Latency for GROUP A was 4.116±0.265ms and for GROUP B was 3.243±1.044ms. Mean±SD for Digit II to Wrist latency for GROUP A was 2.845±0.252ms and for GROUP B was 2.077±0.556ms. Mean±SD for Transcarpal to Wrist latency for GROUP A was 1.854±0.289ms and for GROUP B was 1.414±0.252ms. 't' calculated value for DML, Digit II to wrist and Transcarpal to wrist was 4.43, 6.88 and 6.27 respectively which was statistically significant as it is above the 't' tabulated value of 1.96.

Conclusion: There is a significant difference in both the Groups for all the parameters. GROUP A individuals are having more chances for developing Carpal Tunnel Syndrome when compared to GROUP B individuals.

Keywords: Carpal Tunnel Syndrome, Nerve Conduction Velocity, Computer users and General Population.

INTRODUCTION

Computer is an electronic device which is omnipresent in our society; where more than 50% work is carried out by computers (desktops/laptops). Today computers are widely used with its basic unit like keyboard and mouse in different sectors. About 2 of every 5 employed individuals are connected to use of computers while on the job.[1] As per a recent World Bank's Enterprise Survey of 1,948 retail stores in India, 19% of the stores use computers for their business. In some states like Kerala, computer use is as high as 40%.[2]

Repetitive strain injury (RSI); also known as occupational overuse syndrome, non-specific arm pain or work related upper limb disorder (WRULD); is mainly associated with repeated use of any particular movement like

flexion/extension. RSI includes conditions like De-Quervain's disease, tennis elbow, carpal tunnel syndrome, etc.

Carpal tunnel syndrome (CTS) is described as the triad of nocturnal pain, sensory disturbance in the distribution of the median nerve and thenar atrophy.[3] A study of employees in 21 computer companies in Chennai has revealed that one in eight computer professionals runs the risk of CTS and incidence increases with long hours at computers.[4] Innocuous activities such as typing and clicking a mouse button could possibly be harmful.

Motor nerve conduction velocity measurement employing muscle action-potential was first carried out by Piper (1909) and Munnich (1916).[5] The first usefulness of the median nerve conduction studies in the diagnosis of CTS was done by Simpson in 1956 where he demonstrated slowing of nerve conduction in CTS. NCV studies with a high degree of sensitivity (>85%) and specificity (>95%) constitute an important aspect of the diagnosis of CTS.[6] Nerve conduction change occurs before a patient develops clinical symptoms of CTS that are severe enough to seek medical attention. Many asymptomatic employees can in fact be found to have abnormalities in nerve conduction, so by giving early intervention we can avoid later complication and surgery for them.

In general population like sweepers, house wives, masoning work and so likewise work where they need to move their wrist and finger in above mentioned direction are prone to develop CTS in early or late stage of their life. A study done on general population of middle part of Italy, having population of 120,000 found that in the 8-year period, 3,142 cases were identified as having CTS. The mean annual crude incidence was 329 cases per 100,000 person-years, and the standardized incidence was 276.[7] A repetitive motion of wrist is one of the known causes to develop CTS. Daily high-velocity and high-force manual work is a risk factor for CTS in a working population like Slaughter house worker,[8] Grocery store worker,[9] Industries,[10] Dentist[11] etc. Hence the study was conducted to assess the NCV changes in those people who work using computers and amongst the general population with its main objectives to evaluate and compare the median nerve NCV changes at wrist in computer workers who work for $\geq$ 4 hours per day with those in general population.

METHODOLOGY

Study Design: Cross Sectional Comparative Study

Study Setting: NCV Laboratory of Shree Devi College of Physiotherapy, Mangalore

Sample size: 60 individuals

Sampling method:

The study included a sample of 60 individuals. Out of that 30 individuals were involved in computer work for $\geq$ 4 hours per day from past 1 year and remaining 30 individuals were from general population involved in work like cooking, sweeping and masoning were selected by using Convenient Sampling.

Inclusion criteria:

1) Age: between 20 years to 50 years.
2) People using laptop, desktop or both.
3) Individual working for $\geq$ 4 hours/day for a year or more.
4) Individuals engaged in cooking, sweeping, masoning occupations.
5) Right Hand Dominants

Exclusion criteria:

1) Symptomatic Persons (CTS)
2) People with any other neurological disorder.
3) People with any orthopedic problem.
4) People who have been operated previously for hand.
5) Pregnant women.

6) People with inflammatory joint disease. i.e. Rheumatoid arthritis and obese individuals.

Source of data collection:

1) Computer Centers.
2) House wife, Sweepers and Masons as General population from Mangalore.

Tools used:

1. EMG machine (Neuro care™ – 2000, computerized EMG with NCV and Evoked potentials, Ser. No. 1023. Manufacture Bio-tech™, India.)

Fig 1: Tool Used in Study - Neurocare 2000 EMG /NCV

Outcome measures:

1) Distal Motor Latency of Median Nerve (DML)

2) Sensory Latency of Median Nerve, namely II digit to wrist latency (DII to W) and Transcarpal to wrist latency (TC to W).

Procedure:

Prior to procedure individuals who met the inclusion criteria were assessed and evaluated thoroughly by using the questionnaire (Annexure 1). After signing the consent form they were made to participate in study.

Group A: Consists of 30 individuals without any symptoms of CTS working for $\geq$ 4 hours per day for $\geq$ 1 year.

Group B: Consists of 30 individuals belonging to general population not using computer but engaged in cooking, sweeping, masoning occupations.

Following the above procedure the individuals belonging to all the three groups were tested for the NCV changes of the median nerve for dominant hand. The Procedure for measuring NCV was conducted as per that mentioned in **Clinical Neurophysiology**, 2nd edition, by UK Misra & J Kalita.

Fig 2: Motor Conduction Study

Fig 3: Group A Person using Computer ≥ 4 hours / day

Fig 4: Sensory Conduction from Digit II to Wrist

Fig 5: Group B General Population

Following the recording of the above parameters, the obtained scores were tabulated and compared among both study groups for NCV changes to check the probability of occurrence of CTS amongst them.

Ethical Consideration: Procedures followed were in accordance with the ethical standards of Helsinki Declaration of 1975, as revised in 2000.[12]

Statistical analysis:

All 60 participants of both groups were analyzed for NCV changes.

Unpaired t tests were used to find out homogeneity of two groups for all the demographic parameters and to compare the outcome measurement data between two groups. Each calculated t-value is compared with t-table value to test two tailed hypothesis at 0.05 level of significance. Data analysis software SPSS 13.0 version has been used for the data analysis of the present study.

RESULTS

Table 1: shows descriptive statistics of age distribution among both groups.
Descriptive Statistics

Age (years)	N	Minimum	Maximum	Mean	Std. Deviation	Std. Error of Mean
Group A	30	21.00	35.00	24.9333	3.10654	.56717
Group B	30	21.00	35.00	26.6333	4.39030	.80156

Graph 1: presents comparison of demographic characteristics among both the Groups.

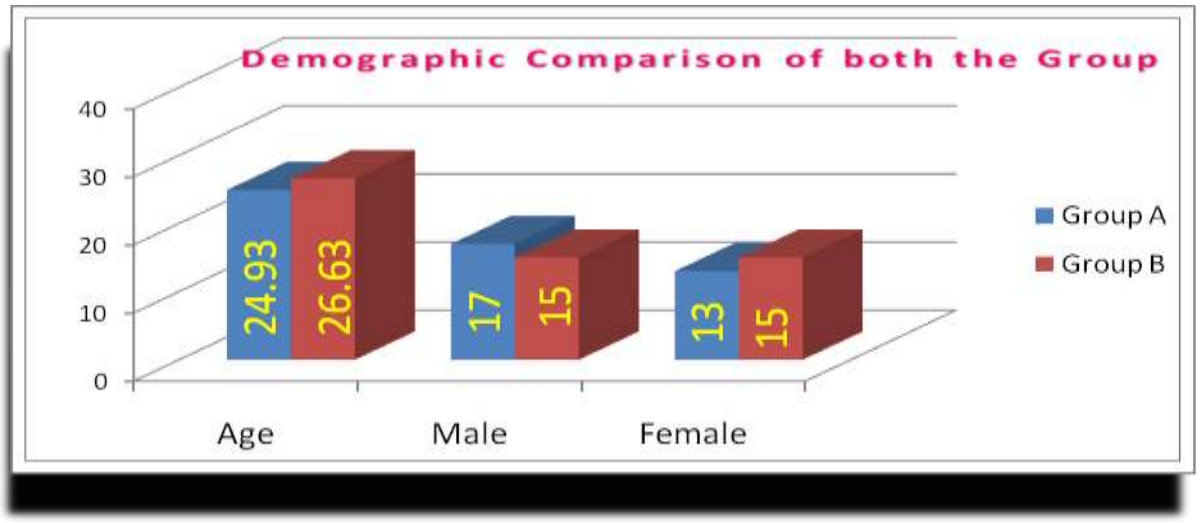

Table 2: shows gender distribution among both the groups.

		Group		Total
		Group A	Group B	
Gender	Female	13 43.4%	15 50.0%	28 46.6%
	Male	17 56.6%	15 50.0%	32 53.4%
Total		30 100%	30 100%	60 100%

Table 3: Unpaired 't' test for age and gender

Independent Samples Test

	t-test for Equality of Means				
	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Age	-1.731	58 52.219	.089	-1.70000	.98192
Gender	1.025	58 58.000	.310	.13333	.13013

Table 3 presents Unpaired 't' test which was calculated at 0.05 level of significance to compare both the groups in terms of age and gender distribution and also to find out the homogeneity of both the groups for comparison of outcome measures. 't' calculated value of age and gender distribution across both groups was -1.731 and 1.025 respectively which was not significant, hence both the groups were comparable.

Table 4: Outcome Measures for Both Groups

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
DML	A	30	4.1167	.26583	.04853
	B	30	3.2437	1.04414	.19063
D II to W	A	30	2.8450	.25268	.04613
	B	30	2.0773	.55608	.10153
TC to W	A	30	1.8540	.28964	.05288
	B	30	1.4140	.25220	.04604

Table 4: shows outcome measures for both the groups. Mean±SD for Distal Motor Latency for GROUP A was 4.116±0.265ms and for GROUP B was 3.243±1.044ms. Mean±SD for Digit II to Wrist latency for GROUP A was 2.845±0.252ms and for GROUP B was 2.077±0.556ms. Mean±SD for Transcarpal to Wrist latency for GROUP A was 1.854±0.289ms and for GROUP B was 1.414±0.252ms.

Graph 2: presents comparison of outcome measures among both the Groups.

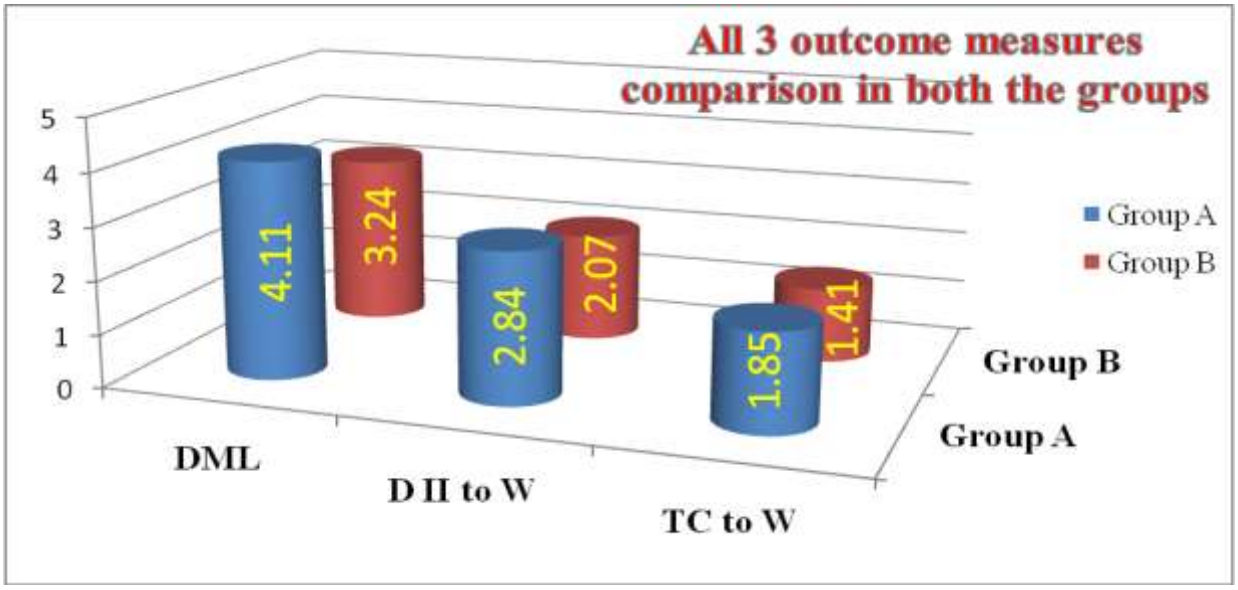

Table 5:'t' calculated value for outcome measures of both the groups

Independent Samples Test

	Levene's Test for Equality of Variances		t-test for Equality of Means						
								95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
DML	9.303	.003	4.438	58	.000	.87300	.19671	.47923	1.26677
			4.438	32.744	.000	.87300	.19671	.47266	1.27334
DII to W	16.126	.000	6.884	58	.000	.76767	.11151	.54445	.99089
			6.884	40.486	.000	.76767	.11151	.54237	.99296
TC to W	.180	.673	6.275	58	.000	.44000	.07012	.29964	.58036
			6.275	56.923	.000	.44000	.07012	.29959	.58041

As evident from table 5, 't' calculated value for DML, Digit II to wrist and Transcarpal to wrist was 4.43, 6.88 and 6.27 respectively which was statistically significant as it is above the 't' tabulated value of 1.96.

DISCUSSION

The study was conducted to examine the changes of NCV in computer workers and amongst the general population. The study was done on 30 individuals with a mean age of 24.93 ± 3.10 who used computer on daily basis > 4 hours / day for 1 year or more and remaining 30 individuals with the mean age of 26.63 ± 4.39 who were involved in cooking, sweeping, masoning, etc.

Distal Motor Latency and Sensory Latency (SNAP) from Digit II to Wrist and Transcarpal region to wrist in dominant upper extremity were evaluated. After retrieving the values, data was statistically compared using Unpaired 't' test for comparison of both the groups.

Result showed that there is significant difference in both the GROUPS when compared in terms of DML, Digit II to Wrist Latency and Transcarpal to Wrist Latency. In all the three outcome parameters, Group A had significantly higher latencies as compared to group B. So we can conclude that there are more chances to develop CTS in GROUP A (Computer users those who use it for $\geq$ 4 hours / day from past 1 year) compared to GROUP B. This can be attributed to the repetitive action of fingers and abnormal wrist postures seen during typing and mouse operating leading to abnormal stress on the underlying tissues especially the nerves.

One of the hallmarks of compressive neuropathies such as CTS is demyelination, producing the reduction in normal conduction of neural impulses, which appears to result primarily from the mechanical disruption of internodal segments, extensive demyelination and persistent compression eventually resulting in direct axonal damage and wallerian degeneration distal to site of injury.

Limitations of the study

- ➔ The study was done on a small sample size.
- ➔ Only Electro diagnostic tool was used to find out CTS.
- ➔ Only Median Nerve value was taken in to consideration.

Scope of further studies

- ➔ Comparison of Sensory and Motor nerve conduction velocity of median and ulnar nerves can give better result.
- ➔ Probabilities of occurrence of CTS based on number of hours spend/day on computer usage can be compared in future.
- ➔ Comparison of dominant to non-dominant hand can be done to check the probability of occurrence of CTS among them.
- ➔ On basis of the acquired results, ergonomic advice can be given to the involved group individuals.

CONCLUSION

Study was done on Computer users and General population involved in cooking, sweeping etc. for assessing the NCV abnormalities and thereby to identify presence of CTS by using parameters like DML (Distal Motor Latency), Latency from IInd Digit to Wrist and Transcarpal region to Wrist. The result showed that there is a significant difference in both the Groups for all the parameters suggesting that among them, GROUP A individuals i.e. computer operators are having more chances for developing CTS when compared to GROUP B individuals, i.e. general population.

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