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ORIGINAL ARTICLE

A Study to Evaluate the Incidence of Carpel Tunnel Syndrome in Long term Keyboard Usage Professionals

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Abstract

OBJECTIVE:–Purpose of this study was to correlate NCS and CTQS to asses the severity of CTS in long term key board users.

METHODS :-35 healthy subjects of age group between 20 and 60 were selected. Written consent was taken from subjects who fulfilled the inclusion criteria and evaluated thoroughly, CTQS was given to subjects and score were obtained. For The selected subjects NCS for the median nerve of dominant extremity was recorded. Both sensory and motor NCS finding were taken from the assessed extremity.

RESULTS:-The correlation of CTQS with sensory symptoms is higher than the motor symptoms. The results also showed that there was no correlation with DKBU and NCS with similar result to CTQS. So we can assume that, there may be some other factors other than DKBU attributed to CTS pathogenesis found no correlation between CTQS and NCS in long term Keyboard user.

CONCLUSION: - The study demonstrated that there is a correlation between CTQS and NCS in long term keyboard user. So we can assume that, there may be some other factors other than DKBU attributed to CTS pathogenesis

Keywords: Musculoskeletal disorders (MSD), carpal tunnel syndrome (CTS), Nerve conduction studies (NCS), Desktop Key Board Users (DKBU) Boston Carpal Tunnel Syndrome Severity Questionnaire (BCTQ), Michigan Hand Outcome Questionnaire (MHQ), Disability of Arm, Shoulder and Hand (DASH), Patient Evaluation Measure (PEM), Historical-Objective scale (Hi-Ob) scale and Upper Extremity Functional Scale (UEFS) Carpel Tunnel Questionnaire Score (CTQS)

1 | INTRODUCTION

Usage of computer is commonly increasing among many working population[1] with estimated range of about 100 million usage recorded in United States in 2010.[2] So their exists a need to rule out about theadverse effect of using a computer on distal upper extremity musculoskeletal disorders (MSD)[3,4] such as, carpal tunnel syndrome (CTS)[5], which may be caused due to repetitive data

entry or keyboard typing[6]. Excessive use (up to 20 hrs/wk) of mouse and keyboard leads to another MSD condition known as tenosynovitis.[1]many researchers conducted studies to known the Frequency of all types of musculoskeletal disorder's and found that there is association existing in between the use of the computer and related MSD's. and CTS found to affected more in frequency in hand symptoms (OR=2.76, CI: 1.51–5.06) among men.[2]

This condition is first described by the **James Paget (1854)** and popularized by **Phalen** & associates in **1950** [7]. CTS is considered as median nerve entrapment neuropathyat wrist caused by compression of median nerve in the carpal tunnel.sensory and motor disturbances arises in case of increased pressure on median nerve in carpal tunnel where disturbances are noted in the area of hand innervated by this nerve[8], which leads to pain and loss of functional activity. Tingling, numbness and decreased sensations are the most common sensory symptoms which occurs in the course of median nerve,[9] the exact indications for median nerve entrapment are: sensory symptoms in 1^{st}, 2^{nd} and 3^{rd} digits, awakening at night and over the carpal tunnel. [10]

The epidemiological evidence suggests that their exists association between MSD's outcomes and computer user posture and keyboard use intensity (hours of computer use per day or per week).[1] CTS development is based on various Critical factors such as on repetitive use of keyboard,excessive force used while typing and users maintaining prolonged awkward and static postures.[11]

The conventional horizontal keyboards, vertical, split keyboard were designed with flexible cushions supporting the wrists, allowing relaxed hand and arm postures. The study conducted to evaluate the effect of using vertical and horizontal keyboard stated that Typing speed rapidly recovered in the users of vertical Keyboards. And also it helped in lowering muscular activity in finger extensor muscles, and improved ones comfort level. Thus, the vertical keyboard was considered to be comfortable which decreases the stress on muscles and sensitive to repetitive strain injuries.[12]**Rempel D. et al.** Conducted a study to rule out effects of keyboard key switch design on computer users with hand paresthesia. The outcome was assessed at 6 and 12 weeks and study was concluded by stating that there was improvement in Phalen test time significant (P=0.006).[13]

In patients with high degree of specificity and sensitivity Nerve conduction studies (NCS) assess the peripheral nerve function by recording evoked potentials to confirm a clinical diagnosis of CTS. After a period of decreased exposure to repetitive work median nerve conduction values were associated with a higher level of CTS and abnormal NCS.[15] The outcome assessment measures such as, Michigan Hand Outcome Questionnaire (MHQ), Disability of Arm, Shoulder and Hand (DASH), Boston Carpal Tunnel Syndrome Severity Questionnaire (BCTQ),Historical-Objective scale (Hi-Ob) scale and Upper Extremity Functional Scale (UEFS) Patient Evaluation Measure (PEM) are used.[16] The BCTSQ is developed in 1993 by **Levine et al.**

This questionnaire consists of symptom severity scale with 11 questions scored from 1 to 5 point and for evaluation of functional status 8 questions with same point scale.[17]This scale has good criterion validity with reliability (0.91), **)** A prospective study conducted by **V.Kamath et al. (2003)** compared the sensitivity of electrophysiological examination and scored questionnaire indiagnosing CTS and founded that questionnaire is 85% and NCS 92% sensitive for CTS with positive predictive value of 90%.[18]

Keeping all the above mentioned points in viewaimof this study is to correlate NCS and CTQS to asses the severity of CTS in long term key board users.

2 | NEED OF STUDY

Usage of Computer these days is a common phenomenon among all the working population so the

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need exists to rule out about adverse effects of it on working individuals among which CTS is considered to be most common problem.

CTS is diagnosed based on the clinical finding correlated with electrophysiological findings with its severity. NCS is although considered as a gold standard technique in ruling out the nerve injuries, Butas it need skill to operate and is contraindicated to perform on the patients with crush injury to hand or metallic implants in the extremity, it is of limited use and not used by the clinicians very often.

The CTQS is also one of the symptom based questionnaire which measures the severity of CTS which is simple and cost effective method in assessing the severity of CTS. So aim of this study is to provide a simple, cost effective and objective tool to the clinician, which assess the severity of CTS.

Aim of the Study: To correlate the CTQS severity score with NCS findings.

3 | METHODOLOGY

35 healthy subjects of age group between 20 and 60 were selected.

Inclusion Criteria: A Keyboard user who uses keyboard > 20 hours/week from 2 years, Subjects aged 18 years and above, both male and female **Exclusion Criteria:** Subjects with cervical radiculopathy and spondylosis, Subjects with diabetic history, Subjects with reflex sympathetic dystrophy, Subjects with distal Forearm bone fracture.

Measurement procedure

Written consent was taken from subjects who fulfilled the inclusion criteria and evaluated thoroughly, CTQS was given to subjects and score were obtained. For The selected subjectsNCS for the median nerve of dominant extremity was recorded. Both sensory and motor NCS finding were taken from the assessed extremity.

Equipment setting:

The bandwidth of the filter setting for Motor conduction studies was 5 Hz- 10 kHz, and for Sensory conduction studies it was 10-2kHz, and sweep speed was kept at 2-5 ms/division.

Subject position- Sitting on back rest chair with pillow in lap to support the forearm and hand of the subject .The hair present on the assessed extremity were shaved and cleaned with spirit to reduce the skin resistance.

Recording procedure: Median nerve:

Sensory component:

NCS for the sensory component of median was carried out by placing the recording ring electrodes with coupling gel at the 2^{nd}interphalangeal joint. Cathode is placed at 2^{nd} PIP Joint and anode is 3 cm distal to it.

Submaximal stimulation was given. Stimulation was given with Bar Electrode at 3 cm proximal to the distal wrist crease.Distal Sensory Latency (DSL) and SNCV were recorded

Motor component:

Recording surface electrode with coupling gel was placed close to motor point of abductor pollicis brevis muscle, reference electrode was placed 3 cm distal at the 1^{st}Metacarpo Phalangeal Joint,

Supramaximal stimulation was given.Median nerve was stimulated at two sites:

- At wrist – 3 cm proximal to distal wrist crease
- At elbow – medial to brachial artery

4 | RESULTS

TABLE 1: Correlation between CTQS with NCV and latency

		LATENCY (ms)		NCV(m/s)	
		DSL	DML	SNCV	MNCV
CTQS	r value	-.917	-.480	.938	.342

Interpretation: correlation between CTQS and SNCV **(r=.938)** and no significant correlation **(r**

=0.342) between CTQS and MNCV in long term Keyboard user and it also shows that CTQS is highly correlated with DSL **(r = -0.917)** and not correlated with DML (**r= -0.480)** in long term Keyboard user.

TABLE 2: Correlation between DKBU with SNCV and MNCV

		SNCV(m/s)	MNCV(m/s)
DKBU	r value	.152	-.242

Interpretation Table 5.6 shows no correlation **(r =0.152)** between DKBU and SNCV as well as no correlation **(r =-.242)** between DKBU and MNCV in long term Keyboard user.

TABLE 3: Correlation between DKBU and CTQS

		CTQS
DKBU	r value	.034

Interpretation: no significant **(r =0.034)** correlation between DKBU and CTQS in long term Keyboard user.

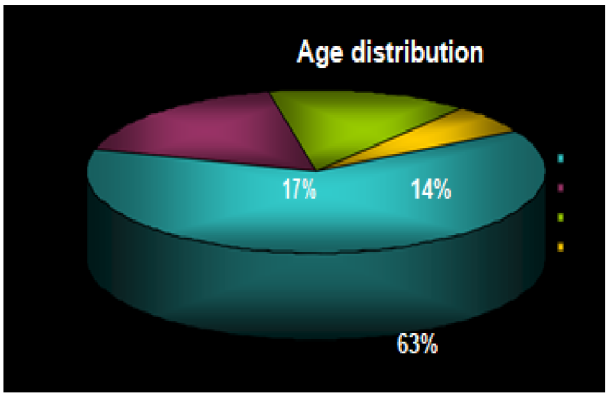

FIGURE 1: Graph showing Distribution of age in groups

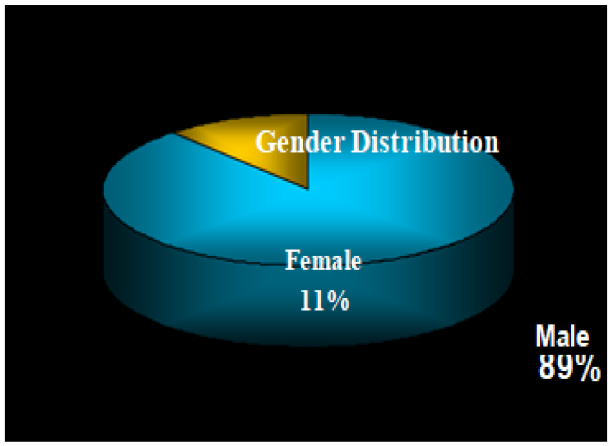

FIGURE 2: Graph showing Distribution of Gender in groups

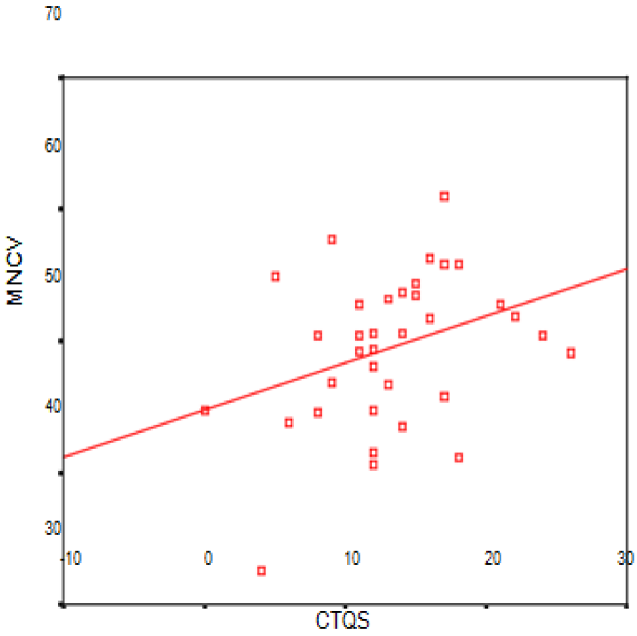

FIGURE 3: Graph showing Correlation between CTQS with MNCV

5 | DISCUSSION

The main subject of this study is on musculoskeletal disorder of upper limb in computer users. A peripheral nerve involvement consists symptoms such as of pain, paraesthesia and weakness. NCS play vital role in research and clinical practice, which can establish the diagnosis more adequately for these conditions. Another tool which measures Severity of the CTS is CTQS which can replace nerve conduction studies in assessment of these nerve related conditions.

The main objective of this study is to correlate the CTQS severity score with NCS findings.This study was conducted on 35 healthy individuals with a mean age of 32.85 ± 9.286 who are being working

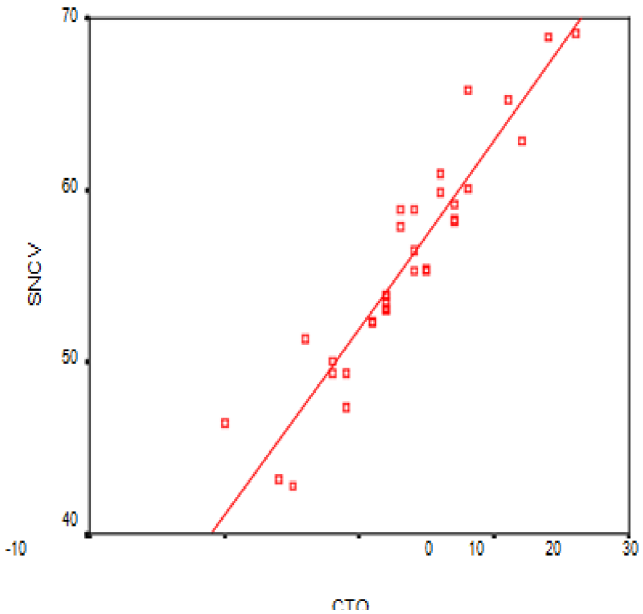

FIGURE 4: Graph showingCorrelation between CTQS with SNCV

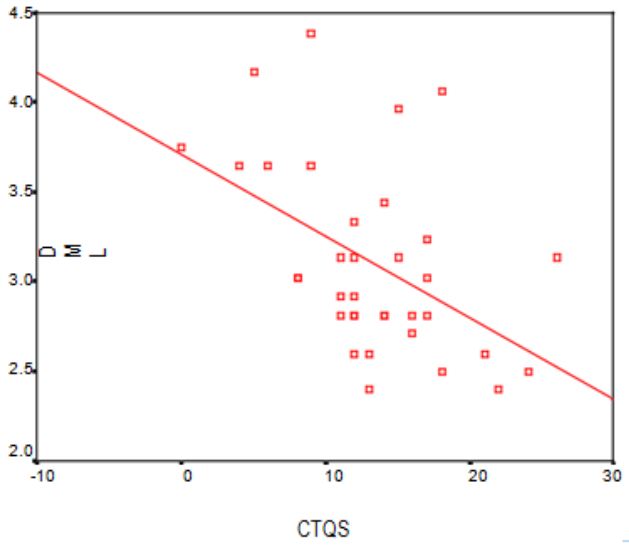

FIGURE 5: Graph showing Correlation between CTQS with DML

on computer keyboard on a daily basis for at least 32hrs/wk. Sensory and Motor nerve conduction studies of median nerve in dominant upper extremities was evaluated. The values obtained from the NCS (NCV, Latency), CTQS and the DKBU values were correlated by using the statistical tool Pearson's Correlation.

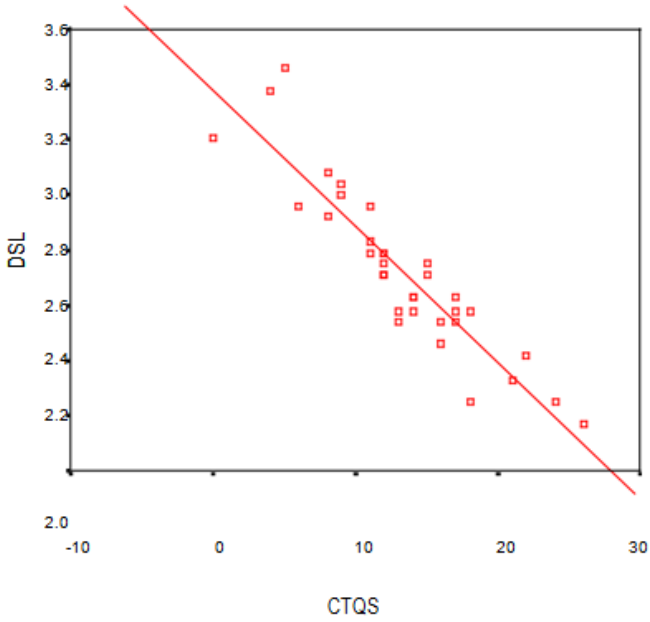

FIGURE 6: Graph showing Correlation between CTQS with DSL

Results of our study showed significant correlation between CTQS and SNCV **(r=.938)** and no significant correlation **(r =0.342)** between CTQS and MNCV in long termKeyboard user. Results also show that the CTQS is highly correlated with DSL **(r = -0.917)** and not correlated with DML (r= -0.480) in long term Keyboard user. In our studywe found a significant correlation between CTQS and SNCV which could be due to the subjects included were not very heavy users of the keyboard and no significant correlation between CTQS and MNCV in long term Keyboard user which requires very heavy use to get affected.

The study conducted by **V. Kamath et al. (2003)** compared the sensitivity of electrophysiological examination and scored questionnaire in diagnosing CTS and stated stated that 92% and 85%of sensitivity respectively and recommended that questionnaire can replaced by nerve conduction studies.

On the other side **N. Heybeli et al.(2002)** studied the relation between Boston Questionnaire and nerve conduction studies pre and post operatively and found there was no correlation existing between NCS and questionnaire score**.** The difference caused may be explained that due to the variability be-

tween symptoms and nerve conduction threshold required for symptom production varies from person to person.[19] **Mondelli et al. (2000)** also found no correlation between Boston Questionnaire and electrophysiological findings[20] **Heecheon Y et al. (1999)** also Examined severity of symptoms in CTS in relation to NCS of median nerve and found that clinical scales can reflect median nerve injury. This supports their potential utility for evaluating the outcome of CTS treatment and developing a model for exposure severity relationship.[21]

Results of our study found no correlation between DKBU with SNCV **(r =0.152)**, MNCV **(r =-.242)** and CTQS **(r =0.034)** in long term Keyboard user.

This can be due to abnormal wrist postures seen during typing and repetitive action of fingers which may lead to abnormal stress on the underlying tissues and nerves which finally results in loss of sensory activity which shows symptoms like pain and paresthesia, thus correlating with SNCV and not correlating MNCV with duration of keyboard use.

It is believed that CTS is caused due to repetitive movements such as flexion and extension of the wrist and fingers which leads to alteration of pressure in the carpal tunnel which further increases pressure on the median nerve mainly in extension. This increased pressure plays an important role in occurence of CTS. There are however few limitations of the which are sample size of study was small ,Age group was not specified, The subjects included in the study for high uses of keyboard was less.

FURTHER RECOMMENDATIONS: Pre and post treatment, the NCV values can be correlated with questionnaire in different duration of keyboard users CTQS can also be correlated with ultra-sonography or magnetic resonance imaging, NCS can be correlated with Neurodynamic testing.

6 | CONCLUSION

The study demonstrated that there is a correlation between CTQS and NCS in long term keyboard user. The correlation of CTQS with sensory symptoms is higher than the motor symptoms. The results also showed that there was no correlation with DKBU and NCS with similar result to CTQS. So we can assume that, there may be some other factors other than DKBU attributed to CTS pathogenesis.

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