# INFLUENCE OF WRIST EXTENSION POSITION ON CARPEL TUNNEL SYNDROME PATIENTS USING MOUSE OF COMPUTER.

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## ABSTRACT

The purpose of study is to investigate the Influence of wrist extension position on carpel tunnel syndrome patients during using mouse of computer **subjects:** ninety males and females mild CTS patients, their age ranged from 40-60 years and their weight ranged from 65-95Kg, they were randomly divided into three equal groups(G1,G2 &G3),G1 was instructed to use mouse of computer for six months with wrist extension from 0-15 degree determined by digital goniometer, G2 was instructed to use mouse of computer for six months with wrist extension from 15-30 degree determined by digital goniometer, G3 was instructed to use mouse of computer for six months with wrist extension from 30-45 degree determined by digital goniometer. All patients assessed by Phalen's sign test, Tinel's sign test, Distal Motor latency, Distal Sensory latency and digital goniometer pre and post the study. **Results**: the study showed that there was slightly significant changes in CTS symptoms occurred in G3 only, however, a little changes of CTS symptoms in both G1and G2 with less worsened for results for G1 regarding to clinical and electrophysiological parameters. **Conclusion:** The degree of wrist extension position can affect on progression of CTS symptoms in patients are using mouse of computer for six month and not less than six hours daily. The more progression of CTS symptoms increase with increasing degree of wrist extension.

***Key words:*** Carpal tunnel, Goniometer, Motor latency, Sensory latency , Wrist extension and Electromyography.

## INTRODUCTION

Carpal tunnel syndrome (CTS) is a compression neuropathy of the median nerve as it passes through the carpal tunnel. CTS are one of the most common upper limb compression neuropathies [25]. It accounts for approximately 90% of all entrapment neuropathies . It is due to an entrapment of the median nerve in the carpal tunnel at the wrist [2]. It is generally believed to be caused by increased pressure in the carpal tunnel [1].

In a recent surveillance study from[7] reported an annual incidence of 139.4 cases per 100,000 in females and 67.2 cases per 100,000 in males, with a female to male ratio of 2.07 [29]. Overall prevalence of 3.0–5.8% among women and 0.6–2.1% among men have been found in general population samples [1]. CTS are diagnosed by a constellation of symptoms which include tingling, nocturnal numbness, pain in the upper extremity, daytime paraesthesia and weakness [15].

Many studies showed that, the odds ratios of 2.3 (95% CI 1.2–4.5) among participants reporting 5–9 h/w of mouse use increasing to 3.6 (95% CI 1.8–7.1) among participants reporting 20–24 h/w of mouse use [(3)].Statistically, the risk of CTS showed that there was significantly increased of CTS symptoms for every 10 hours of repetitive work (OR = 1.86 (95% CI 1.06–3.19)) after adjusting for forceful work and personal characteristics [3].

Experimental studies have shown a higher incidence of CTS in workers who are involved in high force and repetitive work compared to workers who are not. The association between high force / repetitive movements and CTS among 652 workers from 39 jobs from seven different industrial areas . A prevalence of 5.6% among workers in high force and high repetitive

jobs compared to 0.6% among workers in low force and low repetitive jobs [9].

There was a high prevalence of CTS in occupations requiring high force and high repetitive manual movements [18]. The most recent systematic literature review on the role of occupation in carpal tunnel syndrome by[6] found that the regular use of hand-held vibrating tools increased the risk of CTS by more than 2-fold . Also there is substantial evidence for high risk of CTS in occupations requiring high repetitive flexion and extension at wrist and forceful grip[6].

During movements of the fingers and wrist, the finger flexor tendons rub against the walls of the carpal tunnel and the median nerve itself. Although the tendons are lubricated by a special tendon lining and by synovial fluid, certain repetitive movements, especially in combination with forceful gripping, may cause swelling of the tendons or the sheaths surrounding them. Because there is little room for expansion within the tight confinement of the carpal tunnel, the result of swelling is that the softest tissues the median nerve and blood vessels become compressed or pinched[12].

This pressure causes the numbness, tingling, and pain in the wrist and hand that are the primary symptoms of CTS. If pressure on the median nerve increases, affected individuals may experience a temporary loss of control of some of the hand muscles and difficulties in picking up or holding objects. They may also be awakened at night by pain in the hand [19].

The first symptom of CTS is gradual numbness in the areas supplied by the median nerve. This is quickly followed by pain where the nerve gives sensation in the hand. The hand may begin to feel like its "asleep," especially in the early morning hours after a night's rest. Pain may spread up the arm to the shoulder and even to the side of the neck. If the condition progresses, the thenar muscles of the thumb can weaken and atrophy, causing the hand to be clumsy when picking up a glass or cup. If the pressure keeps building in the carpal tunnel, the thenar muscles may actually begin to shrink (atrophy). Touching the pad of the thumb to the tips of the other fingers becomes difficult, making it hard to grasp items such as a steering wheel, newspaper, or telephone [26].

Risk factors associated with carpal tunnel syndrome include obesity, vibratory tool use, diabetes, hypothyroidism and rheumatoid arthritis [19]. It is widely believed that biomechanical factors (e.g. forceful exertions, repetition, and awkward postures) increase the risk of CTS by increasing carpal canal pressure with subsequent nerve ischemia. High repetitiveness seems to be a greater risk factor than high force [21].

An electromyography (EMG) records is used to learn more about the functioning of nerves in the arms and legs [22]. When a normal muscle is at rest, it is electrically silent. A nerve conduction velocity test (NCV), is an electrical test that is used to detect abnormal nerve conditions. NCS are often done along with the EMG to determine if a nerve is functioning normally. The electrodes applied to the skin in various places along the nerve pathway [24]. Then, stimulate the nerve with an electric current. As the current travels down the nerve pathway, the electrodes placed along the way capture the signal and time how fast the signal is traveling. In healthy nerves, electrical signals can travel at up to 120 miles per hour. If the nerve is damaged, however, the signal will be slower and weaker [17].

In this test, the nerve is electrically stimulated at one electrode while a second electrode detects the electrical impulse 'down stream' from the first [27]. This is usually done with surface patch electrodes that are placed on the skin over the nerve at various locations [22]. The distance between

electrodes and the time it takes for electrical impulses to travel between electrodes are used to calculate the speed of impulse transmission. A decreased speed of transmission indicates nerve disease.Normal body temperature must be maintained for the NCV test, because low body temperatures slow nerve conduction [28].

EMG is very good at localizing Median entrapment to the carpal tunnel [23]. Ulnar testing helpful for comparing Median and Ulnar distal latencies, and checking for underlying peripheral neuropathy [22]. EMG findings are prolonged median sensory/motor distal latencies [24]. Recently NCV study included the measurement of motor conduction velocity (MCV), distal motor latency (DML) and compound muscle action potential amplitude (CMAP), sensory conduction velocity (SCV), and sensory nerve action potential amplitude (SNAP) of ulnar and median nerves[22].

## PATIENTS, MATERIALS AND METHODS

**Selection criteria:** This study was conducted on 90 males and females patients with mild unilateral CTS tested by Phalen's sign test, Tinel's sign test and NCV tests. They are diagnosed by the neurologist and were selected from King Khalid Hospital, the Najran University, Kingdom of Saudi Arabia. These patients are followed the following criteria:

Their available age ranged from 40-60 yrs with a mean age of 50.1 years. Their weights ranged from 65-95 Kg with a mean weight of 80.4 Kg. Ninety CTS patients were diagnosed according to physical and physiological tests. They were medically stable by measuring their vital signs which include (Blood pressure, Temperature, Pulse rate and respiratory rate), they were active and co-operative, they were neurological and psychological stable and they had no disability secondary to hand orthopedic problem or surgery. All patients were selected into three experimental groups as: Group 1: 30 patients using mouse of computer at 0-15 degree of wrist extension, Group 2: 30 patients using mouse of computer at 15-30 degree of wrist extension, Group 3: 30 patients using mouse of computer at 30-45 degree of wrist extension.

**Inclusion criteria:** Mild unilateral CTS was diagnosed clinically based on the presence of at least one of the following symptoms; 1) numbness, tingling pain or paraesthesia. 2) precipitation of these symptoms by repetitive hand movement. 3) nocturnal awaking by such sensory symptoms confirmed by electrophysiological criteria. 1) prolonged distal motor latency ≥ 4.4 ms to abductor pollicis brevis 2). prolonged distal sensory latency ≥ 1.9 ms to abductor pollicis brevis (30). Performed by a provider coded as family medicine, primary care, internal medicine, and rheumatology or endocrinology. Including data for at least are median nerve. All patients tested for both upper limb for comparison. The study should apply for at least 6 months from using mouse of computer regularly. The patient who uses mouse of computer, he should use it at least not less than 6 hours daily. Each group should instruct to use mouse of computer in specific determined degree of wrist extension. Angle of wrist extension determined by digital goniometry for each group. All patients should co-operative during test. **Exclusion criteria:** Moderate and severe CTS. Psychological unstable**.** Non co-operative patients during assessment of the research.

**Evaluation procedures:** The data was collected through physical examination (Phalen's tests, Tinel's tests and NCV study).**Phalen's sign test:** It is a method of assessment of CTS which requires a good stability of arm and forearm, a good mobility of wrist and hand. We asked the patient to rest his elbow on a flat surface such as desk or bed, with his elbow bent and

his forearm up then ask him to flex his wrists, letting his hands hang down for about 60 seconds. If he feel tingling, numbness, or pain in the fingers within 60 seconds, he may has carpal tunnel syndrome [31]. **Tinel's sign test:** It is a clinical method to assess the CTS. We asked the adolescence to rest his wrist and hand on the support surface, and then the examiner taps on the inside of his wrist over the median nerve. If his feel tingling, numbness, "pins and needles," or a mild "electrical shock" sensation in his hand when tapped on the wrist, he may has carpal tunnel syndrome [32]. **Electro- diagnostic Test:** Nerve conduction study measures how quickly electrical impulses move along the median nerve from the wrist to the hand and fingers. Technical steps of application NCV including; electrode placement, skin temperature correction, determination of nerve stimulation intensity and analysis of the evoked neuro- electrical response (33). The system comprises an electronic monitor and a report generation system. The registry stores all electro physiological data including raw wave forms and limited demographic information (age, height, weight and gender). The NCV tests are typically performed by official clinical staffs that undergo training by the manufacture. The instrument and the data registry have automated quality assurance software that confirms and tracts ongoing staff competence. Each study is coded with the primary clinical indication for the evaluation of CTS. **Electromyography (EMG) Unit:** It contains of EMG apparatus, Disposable surface EMG electrodes and Data processing computer unit. The neuro pack S1 MEC-9400K, 4 channel EMG/EP system. Disposable and radiolucent electrodes**. Electrodes:** Vitrode F Disposable Electrodes, G210DPart No. F-150M, Adult, solid tape, 25×45 mm, 3 pcs × 50 packs/box. Vitrode V Disposable Electrodes, G272APart No. V-09OM3, Adult/Child, 3 lead, DIN, lead length 1 m, 25×45 mm, 3 colors × 30 packs/box. The electrodes were self adhesive with active surface area of 1cm$^2$ in diameter. The electrodes consist of plastic foam material with a silver plate disc on one side and silver plate snap in the center on the other side. Early released protective sheet is placed over the electrode side to keep the electrolyte part of the disc in its position. The electrodes were connected to EMG apparatus channel. **Patient's preparation:** Before we are putting EMG electrodes over the skin for each patient, it should be shaving the hair at the picking areas and cleaning it by alcohol to remove the dead layers of the skin in site of EMG electrodes (abductor pollicis brevis). **Electrodes testing procedures:** Recording surface electrode was placed on the belly of abductor pollicis brevis muscle. Ring electrode was placed on the proximal interphalangeal joint of the index or thumb for anti-dramic sensory studies. Ground electrode was placed on the level of wrist joint between stimulating and recording electrodes. Reference electrode was placed on distal interphalangeal joint. Stimulating electrode was placed at two different sites on median nerve. Distal on medial part immediately in the groove postero-medial above elbow joint (14 cm above wrist) and proximal on the median nerve above the wrist (8cm above wrist). The duration of the stimulation impulse was 0.2 ms. The latency from the stimulation site to the onset of the negative defection of the sensory potential was determined while the anti-dramic sensory nerve conduction velocity was measured automatically by the device based on the distance between the stimulating site and the recording site.

**Statistical analysis :** The results of three groups were statistically analyzed to compare the differences within each group and between the three groups. The statistical

package of social science (SPSS version 10) was used for data processing the P-value 0.05 level significance.

**Data Summarized by using :** The arithmetic mean average describing the central tendency of observation where The standard deviation (S.D) used to measure to described the results around mean where Paired t-test was performed to determine the significance difference pre and post within the same group . Analysis of variance (ANOVA) was used to compare the differences between the three groups.

## RESULTS

Ninety males and females mild CTS patients participated in the study, their ages ranged between 40-60 yrs with mean age (52.1± 6.6) years, their weights ranged between (60-80Kg) with mean weight (75±7.7Kg). The patients were divided into three equal groups. Each group consisted of thirty patients. The characteristics of patients in each group as shown in table (1).

**Table (1): Characteristics of patients in each group**

| | Group 1 | | Group 2 | | Group 3 | | P |
|---|---|---|---|---|---|---|---|
| | Mean | S.D | Mean | S.D | mean | S.D | |
| Age (yrs) | 56.7 | ± 6.3 | 56.1 | ±7.2 | 56.3 | ±6.2 | 0.81 |
| Weight (Kg) | 75.3 | ± 6.8 | 74.8 | ±8.7 | 75.1 | ±6.6 | 0.87 |

P> 0.05 Significance

The results between three groups showed no significant differences between groups or within groups of age (where prevalence was 0.81) and the weight (where prevalence was 0.87).

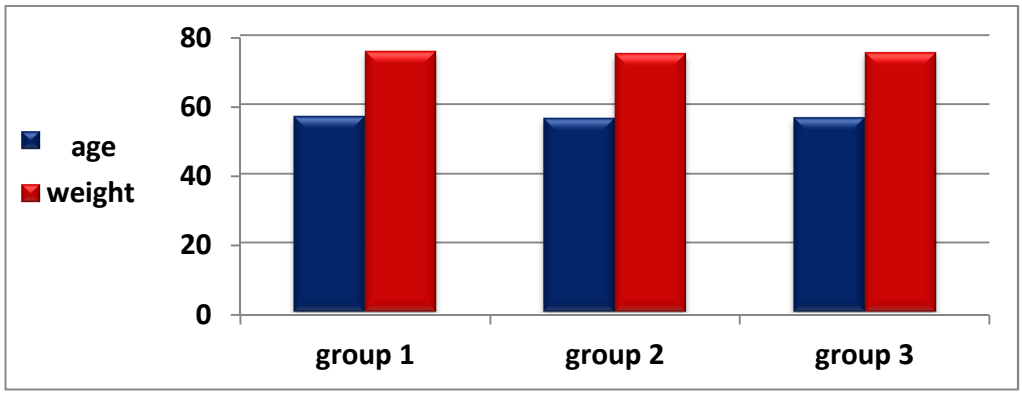


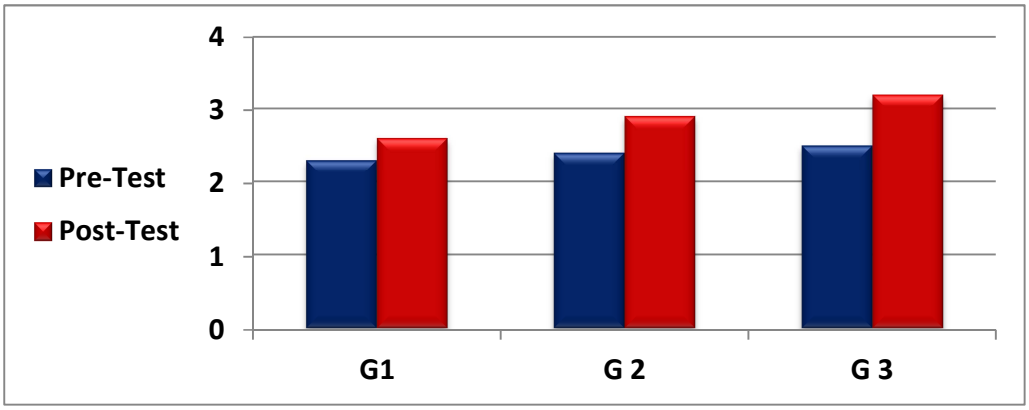

*Fig (1): Characteristics of age and weight in both groups*

**Differences in Phalen's sign between three groups**;

The results between three groups revealed that there were no significant difference in the Phalen's sign test measured before the experimental trial where P value was 0.707 and there is slight significant differences when measured the post experimental trial, where the t value was0.39, while P value was 0.001 as shown in the table (2).

**Table (2) Results between the three groups of Phalen's sign test measured pre and post the experimental trial.**

| | | Mean | S.D | T | P |
|---|---|---|---|---|---|
| G1 | Pre | 2.3 | ±0.5 | 2.82 | 0.064 |
| | Post | 2.6 | ±0.5 | | |
| G2 | Pre | 2.4 | ±0.5 | 10.46 | 0.061 |
| | Post | 2.9 | ±0.7 | | |
| G3 | Pre | 2.5 | ±0.5 | 14.6 | 0.001 |
| | Post | 3.2 | ±0.9 | | |




*Fig(2) Results between the three groups of Phalen's sign test measured pre and post the experiment.*

**Differences in Phalen's sign test within three groups**;

The results of the pre and post test of group (1) revealed that there were slight differences in Phalen's sign test where t value was 2.82 while P value was 0.064, there was a slight differences between pre and post test in the group(2), where t value was 10.46 while P value was 0.061, however, there were slight significant in pre and post test of group (3) where t value was 14. 6 while P value was 0.001 as shown in table(3).

**Table (3): Results within the three groups of Phalen's sign test measured pre and post experimental trial.**

| | | Mean | S.D | P |
|---|---|---|---|---|
| Pre- test | G1 | 2.3 | ±0.5 | 0.707 |
| | G2 | 2.4 | ±0.5 | |
| | G3 | 2.5 | ±0.5 | |
| Post test | G1 | 2.6 | ±0.5 | 0.01 |
| | G2 | 2.9 | ±0.7 | |
| | G3 | 3.2 | ±0.9 | |

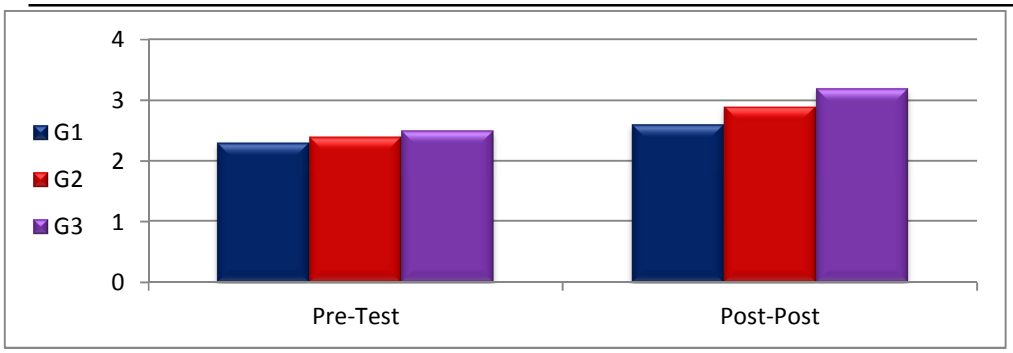



*fig (3): Results within the three groups of Phalen's sign test measured pre and post experiment.*

**Differences in Tinel's sign test between the three group's pre and post experimental trial;**

The results of Tinel's sign test between the three groups revealed that there were no significant differences in CTS signs by Tinel's test measured pre experimental trial where the P value was 0.682 and slight significant differences post experimental concerned with group (3), where P value was 0.001 as shown in table (4).

**Table (4): Results between three groups of Tinel's sign test measured pre and post experiment.**

| | | Mean | S.D | P |
|---|---|---|---|---|
| Pre- test | G1 | 8.7 | ±1.5 | 0.682 |
| | G2 | 8.8 | ±1.4 | |
| | G3 | 8.7 | ±1.5 | |
| Post test | G1 | 9.1 | ±1.5 | 0.001 |
| | G2 | 9.5 | ±1.6 | |
| | G3 | 10.2 | ±1.8 | |

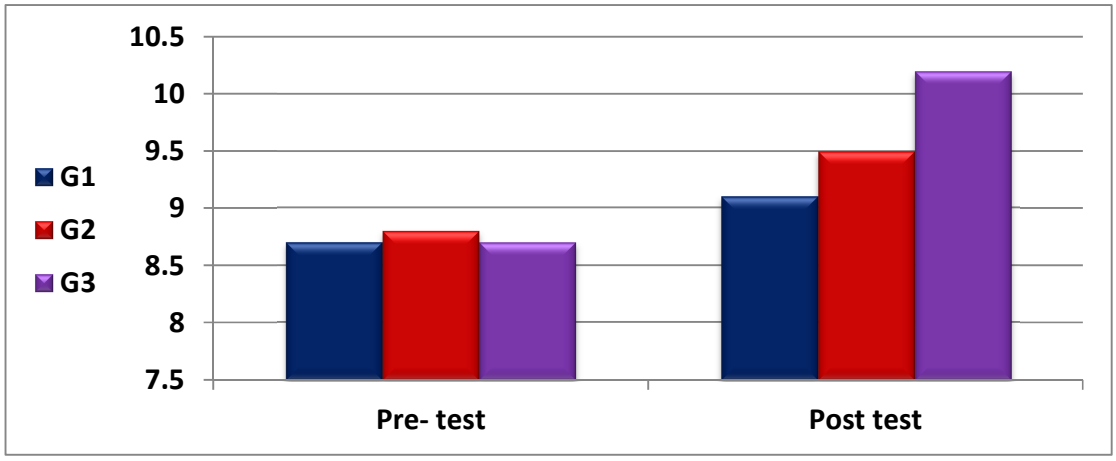


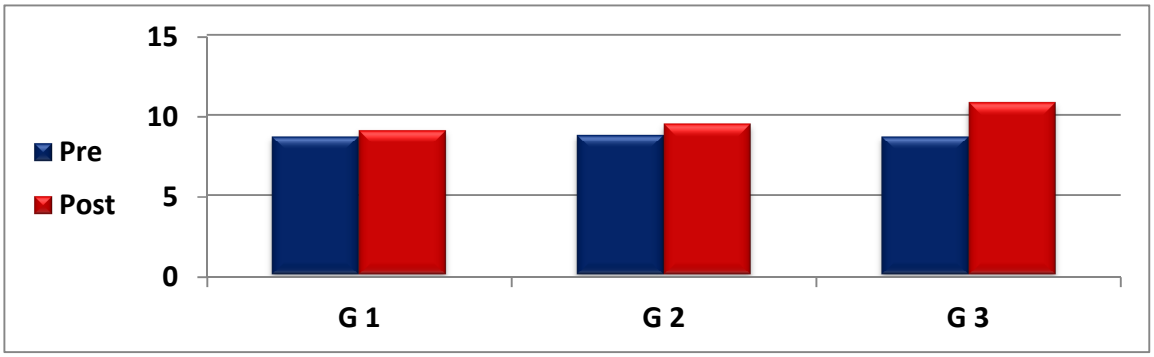

*Figure (4): Results between three groups of Tinel's sign test measured pre and post experiment.*

**Differences in Tinel's sign test within the three groups;**

The results of the test between pre and post test of group (1) revealed that there were slight increase in CTS signs and symptoms where the t value was -12.91, while P was 0.07 and more increase pre and post test of group (2) where t value was -23.44, while P value was 0.09, however slight significant differences between pre and post test of group (3) where the t value was -31, and p value was 0.001 as shown in table (5).

**Table (5) : Results of Tinel's sign test within the three group's pre and post the experiment.**

| | | Mean | S.D | T | P |
|---|---|---|---|---|---|
| G1 | Pre | 8.7 | ±1.5 | -12.91 | 0.07 |
| | Post | 9.1 | ±1.6 | | |
| G2 | Pre | 8.8 | ±1.4 | -23.44 | 0.09 |
| | Post | 9.5 | ±1.5 | | |
| G3 | Pre | 8.7 | ±1.5 | -31.2 | 0.001 |
| | Post | 10.8 | ±1.6 | | |




***Fig( 5): Results of Tinel's sign test within the three group's pre and post the experiment.***

**Differences in motor distal latency studies of median nerve on both sides;**

The results of ninety CTS patients compared on both sides for median nerve showed that there was no significant changes in distal motor latency (DML) and distal sensory latency (DSL ) in group (1), while in group (2) there was slight prolonged median DML and DSL. However, in group (3) there was significant prolonged median DML and DSL as in table (6Λ, B).

**Table 6 (A): Results of electrophysiological findings between three groups measured pre and post for DML.**

| | | Mean | S.D | P |
|---|---|---|---|---|
| Pre- test | G1 | 4.4 | ±0.8 | 0.74 |
| | G2 | 4.3 | ±0.9 | |
| | G3 | 4.2 | ±0.8 | |
| Post test | G1 | 4.6 | ±1.1 | 0.001 |
| | G2 | 4.8 | ±1.3 | |
| | G3 | 5.8 | ±01.6 | |

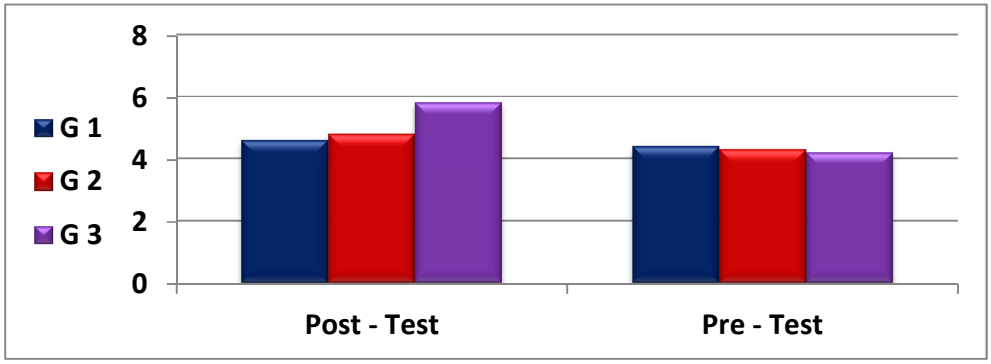



**Fig6 (A): Results of electrophysiological findings between three groups measured pre and post for DML.**

**Table 6 (B): Results of electrophysiological findings between three groups measured pre and post for DSL.**

| | | Mean | S.D | P |
|---|---|---|---|---|
| Pre- test | G1 | 2.9 | ±0.7 | 0.61 |
| | G2 | 2.8 | ±0.8 | |
| | G3 | 2.9 | ±0.7 | |
| Post test | G1 | 3.3 | ±1.1 | 0.001 |
| | G2 | 3.2 | ±1.1 | |
| | G3 | 3.9 | ±01.2 | |

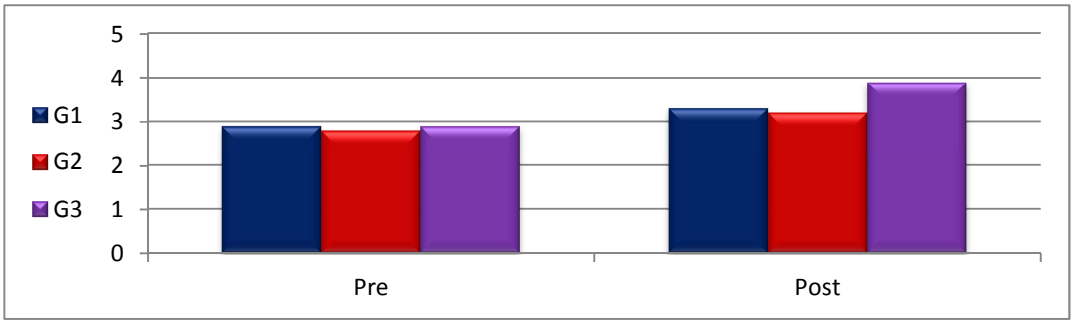



*Fig6 (B): Results of electrophysiological findings between three groups measured pre and post for DSL*

The results of the distal motor latency and distal sensory latency on median nerve of both sides between three groups measured pre and post test revealed that there was no significant differences in DML where the P value was 0.74, while 0.61 for DSL, but there was a significant differences when measured post experimental trial where the p value for DML and DSL were 0.001 as shown in table (6).

The results of the distal motor latency and distal sensory latency on median nerve of both sides within three groups measured pre and post test revealed that in DML there was no significant differences in group1 where the P value was 0.09, while there was slight changes in group 2 where the P value was 0.08, However there was slight significant differences in group 3 between pre and post experimental where the P value was 0.001 as shown in table (7A).

The results in DSL showed that there was no significant differences in group1, where the P value was 0.08, while there was slight changes in group2, where the P value was 0.06, however, there was slight significant differences in group3 where the P value was 0.001 as shown in table (7B).

**Table 7 (A): Results of electrophysiological findings pre and post experimental trials within three groups (DML).**

| | | Mean | SD | T | P |
|---|---|---|---|---|---|
| G1 | Pre | 4.4 | ±0.8 | -12.2 | 0.09 |
| | Post | 4.6 | ±1.1 | | |
| G2 | Pre | 4.3 | ±0.9 | -18.6 | 0.08 |
| | Post | 4.8 | ±1.3 | | |
| G3 | Pre | 4.2 | ±0.8 | -30.2 | 0.001 |
| | Post | 5.4 | ±1.6 | | |

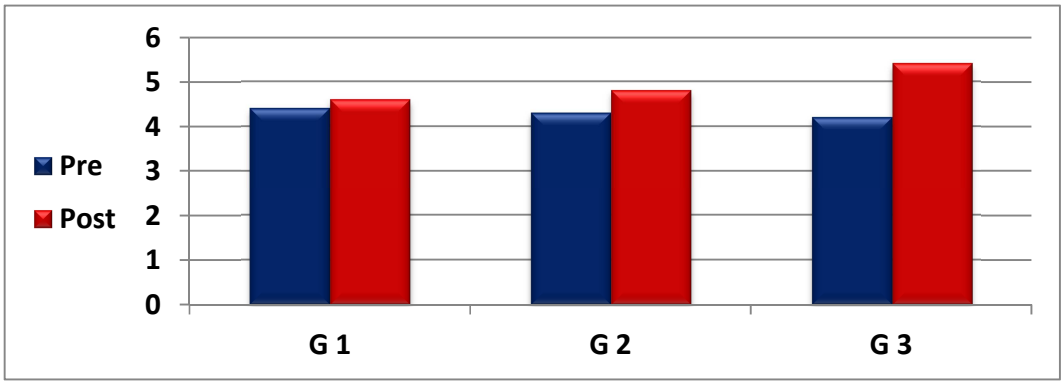



*Fig 7 (A): Results of electrophysiological findings pre and post experimental trials within three groups (DML).*

**Table 7 (B): Results of electrophysiological findings pre and post experimental trials within three groups (Distal Sensory Latency (DSL).**

| | | Mean | SD | T | P |
|---|---|---|---|---|---|
| G1 | Pre | 2.9 | ±0.7 | 2.81 | 0.08 |
| | Post | 3.3 | ±1.1 | | |
| G2 | Pre | 2.8 | ±0.8 | 10.42 | 0.06 |
| | Post | 3.2 | ±1.1 | | |
| G3 | Pre | 2.9 | ±0.7 | 14.51 | 0.001 |
| | Post | 3.9 | ±1.2 | | |

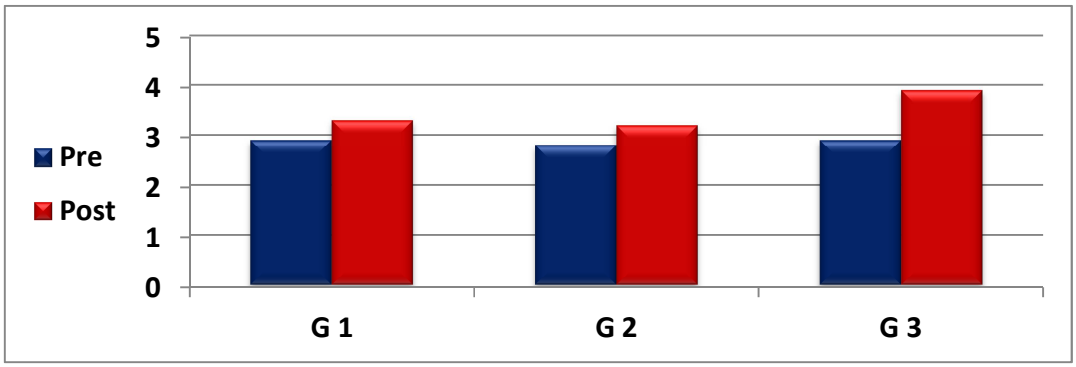



*Fig7 (B): Results of electrophysiological findings pre and post experimental trials within three groups (DSL).*

## DISCUSSION

In this study, we investigate the effect of different wrist extension position during using mouse of computer on CTS. The patients are assessed by Phalen's sign test, Tinel's sign test and NCV for median nerve bilaterally for each of them. Ninety mild CTS patients (same degree of CTS) are randomly divided into three equal groups (G1, G2 and G3). G1 should instructed to

use mouse of computer with 0-15 degree of wrist extension , G2 should instructed to use mouse of computer with 15-30 degree of wrist extension , G3 should instructed to use mouse of computer with 30-45 degree of wrist extension .

During the assessment of this study, the degree of wrist extension for each group determined restrictly by using a digital goniometer and each patient should advised to follow the instruction. The statistics showed that there is nearly no changes in CTS signs and symptoms for G1 and there is lightly increasing in signs and symptoms for G2 but not significant. However, there are mild significant changes in G3 at the end of his study.

Our study showed that there was a weak relationship between the use of computer mouse with different wrist extension angle from 0-30 degree and progression of CTS symptoms with slight significant difference with 45 degree of wrist extension for at least 6 months. The results were confirmed by[13] who demonstrated that position of forearm and wrist can affect on conduction velocity of median nerve (sensory part) especially in certain profession which required repetitive use wrist and hand.

Our assessment in this study revealed that, the degree of wrist extension position may be one factor which can lead to progress of signs and symptoms of median nerve entrapment. Some of these changes or entrapment of median nerve become sever when increasing the degree of wrist extension above 45 degree and become little when using the mouse of computer with less than 30 degree of wrist extension and become not affected when less than 15 degree of wrist extension.

Also, our assessment is agreement with[3] in using Phalen's sign test to asses clinical signs and symptoms in 50 inflammatory CTS patients and 30 traumatic CTS patients. They have suffered from pain, paraesthesia, tingling, numbness and nocturnal pain. In addition[2] used Phalen's sign test in 39 diabetic neuropathy to asses motor evoked potential, distal motor latency and distal sensory latency. Also,[10] used Phalen's sign test to asses 16 CTS patients suffering from rheumatoid arthritis.

In our study, we agree with other authors who mentioned that the Tinel's sign test used in a wide range to assess the CTS patients even in different causes of injury in both gender but differ individually according to severity of lesion. So,[35] used Tinel's sign test to asses 91 CTS patients suffering from pain, tingling, numbness paraesthesia due to nerve neuropathies secondary to their work which required repetitive movement of the wrist and hand. Moreover[36] mentioned that many neurological impairment of CTS can be assessed or diagnosed by Tinel's sign test in 151 CTS patients suffering from ischemic neuropathies in diabetes mellitus.

Also, our NCV study of median nerve assessments (DML and DSL) revealed that nearly no changes in DML and DSL in group1 before using computer mouse (DML 4.4±0.8 ms and 2.9±0.7 for DSL) which become after 6 months (DML 4.6±1.1 ms and 3.3±1.1 ms for DSL) these findings confirmed by Tinel's and Phalen's sign Test in the patients of groupe1, those patients showed no changes in signs and symptoms. Also, G2 showed that there is a little changes in DML and DSL before assessment (DML 4.3±0.9 ms and 2.8±0.8 ms for DSL) which become after 6 months (DML 4.8±1.3 ms and 3.2±1.1 ms for DSL).

The results were confirmed by slight progress signs and symptoms of such as increase pain when applied Tinel's and Phalen's sign test. While in G3 there was slight a significant prolonged DML and DSL before assessment (DML 4.2±0.8 ms and 2.9±0.7 ms for DSL) and they become

(DML 5.4±1.6 ms and 3.9±1.2 ms for DSL) after assessment, the results were confirmed by increase signs and symptoms when applied Tinel's and Phalen's' test after using computer mouse for at least 6 months with 45 degree wrist extension.

In our study, we agree with[34] who mentioned that the CTS symptoms progress with repetitive movements of wrist and hand for long period especially the movements which require skillful movements of hand and fingers. In G3 our study showed that much neurological impairment of CTS increased by increasing wrist angle extension.

Moreover, our results are in accordance with[28] who concluded that CTS symptoms were affected by position of hand and wrist, the median nerve neuropathies increase by increase compression on the nerve sheath which lead to prolonged NCV studied (DML and DSL) of the median nerve at the wrist joint level. Also, the paraesthesia was progressed on the distribution of thenar part and lateral three fingers when increase wrist extension which increase compression on the nerve sheath which lead to decrease circulation to the distal part of the hand and fingers.

The present study is in accordance with[30] who concluded that mild symptoms of CTS clinically one of the primary symptoms numbness, tingling pain or paraesthesia in the median nerve distribution, precipitation of these symptoms by repetitive hand activities which could relieved by resting and nocturnal awaking by such sensory symptoms.

Moreover[31] confirmed that mild CTS diagnosed electro physiologically by presence of one or more of the following standard criteria as prolonged distal motor latency to abductor pollicis brevis, prolonged anti-dramic distal sensory latency to the second digit and prolonged anti-dramic wrist palm sensory conduction time.

In our study we agree with[22] who concluded that the degree of wrist extension position at specific range of movement during using mouse of computer at prolonged time might be progress neuropathies affection of median nerve at carpel tunnel especially on sensory part which leads to paraesthesia, pain at night and it might not respond to medication. Some patients felt coldness accompanied with numbness, tingling and paraesthesia due to affection of the distal circulation to periphery.

Recent studies of CTS suggested that the symptoms progress or become severe for patients who did repetitive and skillful of hand movement and it takes long time to develop the signs and symptoms[23]. In this experimental study, analysis of mean values pre and post assessment by using NCV showed that there were a significant differences between the three groups and the best results were in group1, this mean that using mouse of computer with wrist extension less than 15 degree for at least six months and less than 6 hours daily, it doesn't increase the entrapment of the nerve sheath at carpel tunnel and It doesn't progress CTS signs and symptoms.

Our statistics showed that the assessment of CTS patients either clinically or electro physiologically revealed that the use mouse of computer can't progress pain in patients who are decreasing pads height under the mouse floor which make angle of wrist extension less than 15 degree because if the wrist angle less 15 degree that will prevent median nerve compression and decrease inflammation or swelling which press on the nerve sheath that already decrease compression on the arteries and veins at wrist joint level.

## REFERENCE

1. **Jane F Thomsen, Fred Gerr,#2 and Isam Atroshi#3, Published online 2008** October 6. doi: 10.1186/1471-2474-9-134 (Carpal

tunnel syndrome and the use of computer mouse and keyboard: A systematic review).
2. **Somaiah Aroori and Roy AJ Spence Ulster Med J. 2008** January; 77(1): 6–17. Accepted November 1, 2007.( Carpal tunnel syndrome)
3. **Frans JM Bongers, MD, GP and Francois G Schellevis, MD, PhD, Professor of General Practice. Br J Gen Pract. 2007** January 1; 57(534): 36–39 (Carpal tunnel syndrome in general practice (1987 and 2001): incidence and the role of occupational and non-occupational factors).
4. **De Krom MC, Knipschild PG, Kester AD, Thijs CT, Boekkooi PF, Spaans F. Carpal tunnel syndrome:** prevalence in the general population. J Clin Epidemiol. 1992;45:373–376. doi: 10.1016/0895-4356(92)90038-O.
5. **Atroshi I, Gummesson C, Johnsson R, Ornstein E, Ranstam J, Rosen I.** Prevalence of carpal tunnel syndrome in a general population. JAMA. **1999**;282:153–158. doi: 10.1001/jama.282.2.153.
6. **Palmer KT, Harris EC, Coggon D**. Carpal tunnel syndrome and its relation to occupation: a systematic literature review. Occup Med (Lond). 2007;57:57–66. doi: 10.1093/occmed/kql125.
7. **Andersen JH, Thomsen JF, Overgaard E, Lassen CF, Brandt LP, Vilstrup I, et al.** Computer use and carpal tunnel syndrome: a 1-year follow-up study. JAMA. 2003;289:2963–2969. doi: 10.1001/jama.289.22.2963.
8. **Finsen V, Zeitlmann H.** Carpal tunnel syndrome during pregnancy. Scand J Plast Reconstr Surg Hand Surg. 2006;40(1):41–5.
9. **Silverstein BA, Fine LJ, Armstrong TJ.** Occupational factors and carpal tunnel syndrome. Am J Ind Med. 1987;11(3):343–58.
10. **Chiang HC, Chen SS, Yu HS, Ko YC.** The occurrence of carpal tunnel syndrome in frozen food factory employees. Gaoxiong Yi Xue Ke Xue Za Zhi. 1990;6(2):73–80.
11. 30. **Viikari-Juntura E, Silverstein B.** Role of physical load factors in carpal tunnel syndrome. Scand J Work Environ Health. 1999;25(3):163–85
12. **Nathan PA, Meadows KD, Istvan JA.** Predictors of carpal tunnel syndrome.
13. **Nathan PA, Istvan JA, Meadows KD**. A longitudinal study of predictors of research-defined carpal tunnel syndrome in industrial workers: findings at 17 years. J Hand Surg [Br]. 2005;30(6):593–8.
14. **Gerr F, Letz R, Harris Abbott D, Hopkins LC.** Sensitivity and specificity of vibrometry for detection of carpal tunnel syndrome. J Occup Environ Med. 1995;37:1108–1115. doi: 10.1097/00043764-199509000-00012.
15. **Burke DT, Burke MA, Bell R, Stewart GW, Mehdi RS, Kim HJ.** Patientive swelling: a new sign for carpal tunnel syndrome. Am J Phys Med Rehabil. 1999;78(6):504–8.
16. **McGrath MH.** Local steroid therapy in the hand. J Hand Surg [Am]. 1984;9(6):915–21.
17. **Stolp-Smith KA, Pascoe MK, Ogburn PL.,** Jr Carpal tunnel syndrome in pregnancy: frequency, severity, and prognosis. Arch Phys Med Rehabil. 1998;79(10):1285–7.
18. **Hagberg M, Morgenstern H, Kelsh M.** Impact of occupations and job tasks on the prevalence of carpal tunnel syndrome. Scand J Work Environ Health. 1992;18(6):337–45.
19. **Lam N, Thurston A.** Association of obesity, gender, age and occupation with carpal tunnel syndrome. Aust N Z J Surg. 1998;68(3):190–3.
20. **De Krom MC, Kester AD, Knipschild PG, Spaans F**. Risk factors for carpal tunnel syndrome. Am J Epidemiol. 1990;132:1102–1110.
21. **Nathan PA, Meadows KD, Doyle LS.** Occupation as a risk factor for impaired sensory conduction of the median nerve at the carpal tunnel. J Hand Surg Br. 1988;13:167–170.
22. **Diagnostic Utility of Ultrasonography** Versus Nerve Conduction Studies in Mild Carpal Tunnel Syndrome MAURO MONDELLI,1 GEORGIOS FILIPPOU,2

ADRIANA GALLO,2 AND BRUNO FREDIANI2.

23. **Jennifer Moriatis Wolf & Sally Mountcastle &Brett D. Owens .**Received: 10 December 2008 / Accepted: 5 January 2009 / Published online: 27 January 2009# American Association for Hand Surgery 2009.( Incidence of Carpal Tunnel Syndrome in the US Military Population).
24. **Nerve conduction studies** as a routine diagnostic aid in carpal tunnel syndrome S. A. Wright and N. Liggett Rheumatology 2003; 42: 602-603.
25. .**Eversmann WW., Jr .** Entrapment and compression neuropathies. In: Green DP, editor. Operative hand surgery vol 2. New York: Churchill Livingstone; 1993. pp. 1341–85.
26. . **Omer GE., Jr** Median nerve compression at the wrist. Hand Clin. 1992;8(2):317–24.]27.. Blanc PD, Faucett J, Kennedy JJ, Cisternas M, Yelin E. Self-reported carpal tunnel syndrome: predictors of work disability from the National Health Interview Survey Occupational Health Supplement. Am J Ind Med. 1996;30(3):362–8.
27. **Patterson JD, Simmons BP.** Outcomes assessment in carpal tunnel syndrome. Hand Clin. 2002;18(2):359–63. Viii
28. . **Katz JN, Simmons BP.** Clinical practice. Carpal tunnel syndrome. N Engl J Med. 2002;346(23):1807–1812.
29. 17. **Bland JD, Rudolfer SM**. Clinical surveillance of carpal tunnel syndrome in two areas of the United Kingdom, 1991–2001. J Neurol Neurosurg Psychiatry. 2003;74(12):1674–9. [PubMed]
30. **Chang MH, Liu Lh, Lee Yc, Hsieh PF** (2008): alteration of proximal conduction velocity at distal nerve injury in carpel tunnel syndrome; demyelinating versus axonal change.J.clin.Neurophysiol.Vol (25),P.P161-166.
31. **Haverton EA,Hostson JR,Kelerth JD** (2005): partial peripheral motor nerve lesions induce changes in the conduction properties of remaining intact motorneurons. Muscle Nerve, Vol (24), PP662-666.
32. **Hansson S** (2008) : Dose forearm mixed nerve conduction velocity reflects retrograde changes in carpel tunnel syndrome? Muscle Nerve, Vol (17), Pp725-729.
33. **Jung SH,Paik Nj, Bang MS and Han TR** (2005) : Comparism of various clinical scales with electrophysiological scales for carpel tunnel syndrome. J Korean ASSOC. Electrodign Med, Vol(7),PP 79-89.
34. **Leffler CT, Gozani SN, Cros D** (2008): Median neuropathy at the wrist: diagnosed utility of clinical findings and an automated electro diagnostic devices.J.occup Enciron,Med.Vol.42,PP398-409.
35. **Bucthhal F, Ro Senfalch A and Trojaberg w** (2007); Electro physiologic findings in entrapment of the median nerve at the wrist and elbow.J.Neurol.Neurosurgery.Psychaiatry, Vol.37,Pp 340-360.
36. **Martinze Ac** (2008): Diagnostic yield of different electrophysiologic methods in Carpel tunnel syndrome. Muscle nerve, Vol14,PP183-184.

# تأثير وضع فرد مفصل الرسغ على مرضى متلازمة النفق الرسغي لمستخدمي فأرة الحاسوب

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**الغرض من الدراسة هو دراسة تأثير درجة فرد مفصل الرسغ على مرضى متلازمة النفق الرسغي لمستخدمي فأرة الحاسوب ٠**

**الطريقة : تسعون مريضا من الذكور والإناث مصابون بمرض متلازمة النفق الرسغي متوسط الشدة حيث تراوحت أعمارهم بين ٤٠-٦٠سنة وأوزانهم مابين ٦٥-٩٥كجم ٠ تم تقسيمهم عشوائيا إلى ثلاث مجموعات ، المجموعة الأولى تم إلزامها بفرد مفصل الرسغ بين ٠-١٥ درجة وذلك عند استخدام فأرة الكمبيوتر حيث حددت هذه الزاوية باستخدام جهاز قياس مدى حركة مفصل الرسغ الألكترونى وذلك لمدة ستة شهور ، وألزمت المجموعة الثانية بفرد مفصل الرسغ ١٥-٣٠ درجة وذلك عند استخدامها لفأرة الكمبيوتر ولنفس المدة وحددت الزاوية بنفس الجهاز ، أما المجموعة الثالثة فألزمت بفرد مفصل الرسغ بين ٣٠-٤٥ درجة٠ تم تقييم جميع المرضى باستخدام اختبار فالين وتنل وقياس مسافة سرعة توصيل العصب الحركي والحسي لعصب الرسغ وقياس مدى حركة مفصل الرسغ بجهاز قياس مدى الحركة الألكترونى قبل وبعد الدراسة٠النتائج: أوضحت النتائج أن هناك تغيرات ذو دلالة واضحة في زيادة أعراض المرض في المجموعة الثالثة وتغيرات في المجموعة الثانية وكان أقل هذه التغيرات في المجوعة الأولى مما يدل على أن أعراض المرض تزداد كلما زادت درجة فرد مفصل الرسغ٠**

**الكلمات الدالة: متلازمة النفق الرسغي – جهاز قياس مدى الحركة الألكترونى – مسافة توصيل العصب الحركي والحسي- فرد المفصل٠**