

# The Impact of CTS on Computer-Games Playing:

## A Study Among Malaysian University Students

[Nurul Hidayah Mat Zain, Azizah Jaafar, Fariza Hanis Abdul Razak]

**Abstract**—Carpal Tunnel Syndrome (CTS) is known to be one of the hand complications resulting from prolonged static posture and high muscle tension, particularly during computer-game playing. This study focuses on examining the impact of CTS during computer-game playing among university students in Malaysia. For the purposes of this study, students in the age range of 18-25 years and have experiencing hand discomforts, such as numbness, tingling, pain or burning sensations while playing computer games were approached. A Boston Carpal Tunnel Questionnaire (BCTQ) was administered and students reported on the frequency, the severity of CTS and experiences during computer-game playing. The commonest symptom was numbness. Most of the symptom cases were mild and half of the respondents also described having hand difficulty. This problem creates a great impact relating to their subsequent playing experiences. This study shows that, CTS among the students is in the mild category.

**Keywords**—Computer Games, Carpal Tunnel Syndrome, Boston Carpal Tunnel Questionnaire, Computer-Game Playing, Impact, Enjoyment

### I. Introduction

Nowadays, computer games have become an important part of entertainment activities and are particularly engaging for students, specifically university students [1]. This becomes a phenomenon, as computer games offer enjoyable activities [2]. The computer game also was developed to offer enjoyable for an extraordinary user such as for motor-impaired user and dyslexic children [3], [4].

In recent years, researchers have been interested in the connection between computer games and the aggressive behavior of students [5], [6]. In addition, many concerns have been raised relating to health effects, such as obesity and poor cardiovascular fitness [7], [8].

Further, previous studies have reported that computer-game playing involved long periods of static body posture and highly repetitive thumb and finger movements [9], [10]. It is well known that the prolonged static posture and high muscle tension associated with computer use can contribute to chronic neck and shoulder pain, forearm tendonitis and Carpal Tunnel Syndrome (CTS) [11], [12].

### II. Background Study

Carpal Tunnel Syndrome (CTS) occurs from compression of the median nerve where it passes through the carpal tunnel in the wrist [13]. Based on clinical symptoms and nerve conduction tests (NCT), an overall prevalence of 3.0–5.8% among women and 0.6–2.1% among men have been found in general population samples [14]. CTS might also trigger sensations such as pain, numbness and tingling in the median nerve distribution in the hand. It is now widely accepted that exposure to hand-arm vibrations and exposure to a combination of repetitive and forceful hand usage may be the root cause of the problems [13]. The CTS symptoms affect everyday activities such as driving, holding a telephone, performing repetitive tasks [15] and the use of a computer for long periods of time [16], [17].

There is very limited published information about prolonged computer-game playing that can contribute to the development of CTS. CTS might be the least of the problems that affect a user while computer-game playing, but the fact is; there is no real data to address this problem. The purpose of this study is to find out the impact of CTS towards computer-game playing. It also seeks to address how CTS affects their enjoyable experience while playing computer-games.

### III. Method

#### A. Study Design

This was an exploratory study conducted to examine the frequency and severity of CTS, as well as experiences while computer-game playing among university students aged 18 – 25 years. The frequency and severity of CTS were evaluated using an adapted Boston Carpal Tunnel Questionnaire (BCTQ) [15]. In addition, experiences while computer-game playing were evaluated by adapting items from several published questionnaires.

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## B. Participants

The participants were students from Faculty Computer and Mathematical Sciences (FSKM), UiTM. Only students who were experiencing hand discomforts (numbness, tingling, pain or burning sensations) while playing computer games were approached. After obtaining consent, students having symptoms other than median nerve distribution, abnormal lumps at the hand or wrist, diabetes mellitus, hypertension, trauma at the hand or wrist and a previous diagnosis of CTS and recurrent CTS were excluded. This was done to ensure that the respondents in this study were experiencing solely CTS symptoms.

## C. Instruments

The instrument for the study of symptom severity and functional severity of CTS was adapted from the Boston Carpal Tunnel Questionnaire (BCTQ) [15]. BCTQ is a self-administered questionnaire, a well-recognized and validated outcome instrument, specifically for use in the CTS. It has been compared with different outcome measures [18] and has been validated in other languages [15]. It comprises two sections, namely: one assessing symptom severity (BCTQ-SS), and the other analyzing functional severity (BCTQ-FS). In addition to BCTQ, the instrument was designed by adapting items from several published questionnaires that had previously investigated the gaming experience.

## D. Data Analysis

The data were analyzed using SPSS 19. In order to estimate the frequency (%), standard descriptive statistical methods were used for variables. Relationships among categorical variables, including the BCTQ-SS and BCTQ-FS, were determined using the Chi-Square ( $\chi^2$ ) test. The BCTQ-SS and BCTQ-FS score was also summed up in set totals, as proposed by Store et.al [19]. The score totals used for symptom severity were categorized into the following areas: asymptomatic (11), mild (12-22), moderate (23-33), severe (34-44) and very severe (45-55). At the same time, function scores were grouped into categories of, namely: asymptomatic (8), mild (9-16), moderate (17-24), severe (25-32) and very severe (33-40) [20].

## IV. Result

In total, 120 respondents agreed to participate in this study. All of the respondents were computer game users. The demographic data of the respondents are presented in Table I. The table showed that the frequency (%) of female respondents was almost twice as high as that of the male respondents. It was equally distributed in the age group of 20 – 25 years, with only a small percentage being 18-19 and >25 years old. This profile was fairly typical of undergraduates in the Malaysian population [21]. The demographic profile also showed about 41.7% respondents were at a moderate experience level in computer games.

Table I. Demographic profile of respondents ( $n = 120$ )

Demography	Range	Male	Female	Total
Number of game users: n (%)		41 (34.2%)	79 (65.8%)	120 (100.0%)
Age distribution: n (%)	18-19	1 (0.8%)	0 (0.0%)	1 (0.8%)
	20-22	24 (20.8%)	61 (50.8%)	85 (70.8%)
	23-25	15 (12.5%)	14 (11.7%)	29 (24.2%)
	>25	1 (0.8%)	4 (3.3%)	5 (4.2%)
Experience level in computer games: n (%)	Novice	0 (0.0%)	1 (0.8%)	1 (0.8%)
	Moderate	14 (11.7%)	36 (30.0%)	50 (41.7%)
	Experienced	11 (9.2%)	33 (27.5%)	44 (36.7%)
	Very Experienced	16 (13.3%)	9 (7.5%)	25 (20.8%)
Dominant hand	Right	37 (30.8%)	73 (60.8%)	110 (91.7%)
	Left	4 (3.3%)	6 (5.0%)	10 (8.3%)

## A. BCTQ-Symptom Severity (BCTQ-SS)

The most common presenting symptom from the BCTQ-SS, as reported in Fig. 1 was numbness ( $n = 79$ , 65.8%), where 48 (40.0%) had mild numbness, 23 (20.8%) moderate numbness, 7 (5.8%) severe numbness and 1 (0.8%) had very severe numbness. Other commonly-occurring symptoms were, namely: a tingling sensation ( $n = 78$ , 65%), weakness ( $n = 67$ , 55.8%), numbness and tingling during the daytime ( $n = 57$ , 47.5%), waking up due to pain ( $n = 44$ , 36.7%), pain during the daytime ( $n = 40$ , 33.3%), while the least common symptom was difficulty in grasping and using a small object ( $n = 38$ , 31.7%).

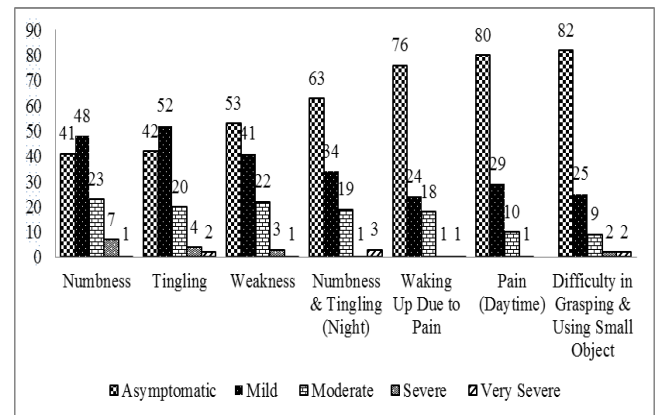


Fig. 1 Frequency of symptom severity

Table II is shown numbness symptoms experienced by respondents and its cross tabulation between gender. Obviously, both males and females experienced mild numbness with males being ( $n = 16$ , 33.3%) and females being ( $n = 32$ , 66.7%). Both males and females also had almost equally asymptomatic respondents. It is surprising that no male respondent has experienced a severe numbness category, even though most of them reported playing computer games a few times a week.

Table II. Numbness symptoms and cross tabulation between genders

		Gender		Total
		Male	Female	
Asymptomatic	Count	21	20	41
	% within Numbness	51.2%	48.8%	100.0%
Mild Numbness	Count	16	32	48
	% within Numbness	33.3%	66.7%	100.0%
Moderate Numbness	Count	2	21	23
	% within Numbness	8.7%	91.3%	100.0%
Severe Numbness	Count	2	5	7
	% within Numbness	28.6%	71.4%	100.0%
Very Severe Numbness	Count	0	1	1
	% within Numbness	.0%	100.0%	100.0%
		% within Gender		
		100.0%	100.0%	100.0%

### B. BCTQ-Functional Severity (BCTQ-FS)

The function from the BCTQ-FS according to task is shown in Fig. 2. The tasks that are commonly affected included: carrying grocery bags ( $n = 44$ , 36.7%), followed by writing ( $n = 37$ , 30.5%), doing household chores ( $n = 33$ , 27.5%), opening a jar ( $n = 32$ , 26.7%), holding a book ( $n = 30$ , 25.0%), gripping a telephone ( $n = 22$ , 18.3%), bathing and dressing ( $n = 18$ , 15.0%) and buttoning clothes ( $n = 9$ , 7.5%).

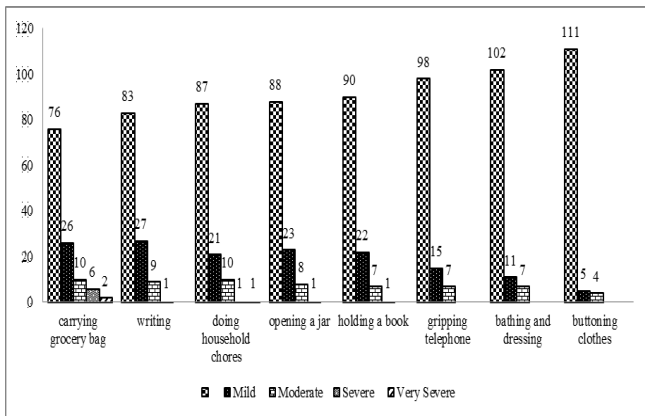


Fig. 2 Frequency of functional severity

### C. User Experience on computer-game playing

All of the respondents ( $n = 120$ ) were experienced in computer-game playing. The frequency and experience levels are summarized in Table III. This shows the highest numbers of respondents range from the moderately experienced level category, followed by the experienced level category. The

frequency of computer-game playing among respondents indicated relatively higher percentages on a weekly or daily basis, as compared with a monthly basis.

Table III. Four experience levels in computer games and how often they play ( $n = 120$ )

	Once a month (n, %)	Few times a month (n, %)	Few times a week (n, %)	Every day: < 1 hour (n, %)	Every day: 1- 3 hours (n, %)	Every day: > 3 hours (n, %)
Novice	1 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Moderate Experienced	19 (38.0%)	8 (16.0%)	14 (28.0%)	3 (6.0%)	5 (10.0%)	1 (2.0%)
Very Experienced	2 (4.50%)	10 (22.7%)	13 (29.5%)	8 (18.2%)	7 (15.9%)	4 (9.10%)
Very Experienced	4 (16.0%)	3 (12.0%)	11 (44.0%)	2 (8.0%)	3 (12.0%)	2 (8.0%)

Fig. 3 shows respondents' experiences while computer-game playing. The noticeable finding from this study is that respondents found that symptoms in the hand and wrist appear during prolonged of computer-game playing ( $n = 82$ , 68.3%). Only ( $n = 9$ , 7.5%) of them strongly disagreed with this. More than half of the respondents ( $n = 90$ , 75%) agreed that user interface for special needs should be designed. Respondents also agreed that users should be involved in designing the interface of computer games ( $n = 88$ , 73.3%). Approximately half of the respondents ( $n = 50$ , 41.7%) strongly agreed that enjoyment is one of the important factors to be taken into account when designing computer games. This result shows that respondents highly agreed with the idea of designing an enjoyable user interface for special needs users, especially for those having hand and wrist problems, with users being involved in the design phase.

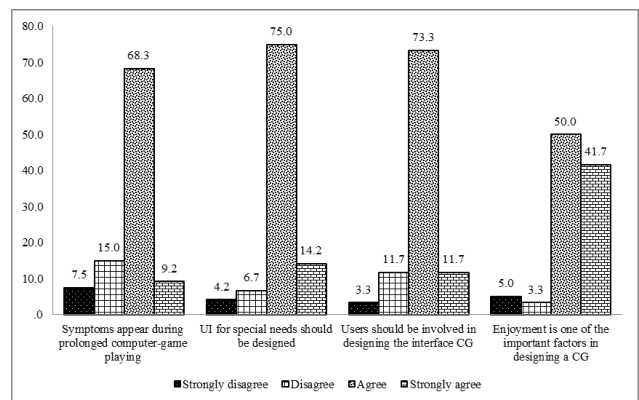


Fig. 3 Frequencies (%) of the respondents' experience while computer-game playing

## v. Discussion

The results in Fig. 1 is shown that the symptoms of CTS among Malaysian university students were concentrated more on numbness and tingling. Although more than 70% of CTS cases were found to be mild, half of the students with CTS had some degree of functional difficulties. The most affected tasks were carrying grocery bags and writing.

This study also showed that computer games are popular among students in Malaysia. The result is consistent with the findings of [22]. Their target users are all university students, and the study found that practically all of the students are active in computer-game playing. In fact, about 35% of them reported playing games keenly every day. This scenario supports rapid advances in computer game technology research, such as eye gaze interaction [23], [24] and computer game evaluation [25], [26]. As a result, it leads to more computer games being constantly developed. This was reflected in the observation of the increasing usage of computer games as a learning tool among students in Malaysia [27].

In recent years, researchers have shown their interest in the impact of computer game applications. Unfortunately, it focused mainly on ordinary users and not extraordinary users [4]. This current study specifically focused on university students who were experiencing hand discomforts when playing the computer games. These students can be grouped as motor-impaired users [28]. The results on the severity of CTS relate to prolonged computer-game playing. Our future works will focus on strengthening the interaction design for motor-impaired users, especially for users having hand and wrist problems. We will then conduct an evaluation after computer-game playing to assess the effect of interaction design for these types of users (motor-impaired with hand and wrist problems).

## vi. Discussion

The present study examined the impact of Carpal Tunnel Syndrome (CTS) during computer-game playing among university students in Malaysia (18–25 years old), who had experienced hand discomforts whilst gaming. Students in this age group may be very attracted to computer games. Results from this study showed that about 31.7% of the undergraduates were playing computer games on a weekly basis. The current study also examined the severity of CTS among university students in Malaysia, where most of the case symptom are in the mild category. The results emphasize the need to develop a rigorous enjoyable interaction design for motor-impaired users, especially for users having hand and wrist problems. At the same time it would be able to reduce symptoms of CTS during computer-game playing.

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