



# Is typing speed proportional to the severity of pain in keyboard workers with work-related upper limb disorder

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## DECLARATIONS

### Competing interests

None declared

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### Ethical approval

Not applicable

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BP

### Contributorship

BP is the sole contributor

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### Reviewer

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## Summary

**Objectives** To investigate if the typing speed is proportional to the severity of pain in keyboard workers with work-related upper limb disorder (WRULD).

**Design** Standardized functional typing test with participants scoring pain before and after typing; calculation of typing speed.

**Participants** Fifty-nine patients and six controls.

**Setting** Tertiary hospital centre for hand and upper limb pain.

**Main outcome measures** Pain (VAS 0–10) and calculation of typing speed as words per minute.

**Results** Three subgroups of patients were found based on their typing speed: fast, slow and intermediate. The typing speed was significantly higher in the 'fast' group than in the control group and significantly lower in the 'slow' group. The 'intermediate' group was significantly faster than the 'slow' group. The pain was highest in the 'slow' group, both before and after typing. In the 'fast' group the pain severity was significantly lower in the left hands compared to the right side both before and after typing.

**Conclusion** Typing speed is not proportional to the severity of pain in keyboard workers with WRULD. Patients with statistically significant slower or faster typing speeds do not have statistically different levels of pain.

## Introduction

Upper limb pain in keyboard workers is a common problem though the causes are debated. In the USA cumulative trauma disorders account for 60% of all occupational injuries and the estimated prevalence of these injuries is approximately 30% and the incidence is rapidly increasing. Conservative interventions play a major role in the treatment though older review

studies suggest that it is unclear how effective such interventions are.<sup>1</sup> This type of injury was previously known as repetitive strain disorder (RSI) or cumulative traumatic disorder suggesting that the repetitive nature of the job was causative in developing the problems observed. Indeed some papers suggest that adopting a lower typing speed may compensate for keyboard-induced problems.<sup>2</sup> It has been shown that healthy typists who typed for long periods

developed increasing pain but that this did not lead to a reduction in the typing speed.<sup>3</sup> This observation suggests that most typists have a fixed typing speed and will have to completely rest in order to recover from typing-induced hand pain, a condition also known as work-related upper limb disorder (WRULD). It was therefore of interest to perform an audit of previously obtained clinical investigative results to investigate if the typing speed is proportional to the severity of pain in this group of keyboard workers with work related upper limb disorder.

## Material and Methods

Fifty-nine keyboard working patients with work-related upper limb pain were investigated and their results were compared with results of six normal controls.<sup>4</sup>

The participants subjectively located their pain to the right, left or both hands and scored their pain intensity on a scale of 0–10. The objective assessment included a standardized typing test as described by Povlsen and Rose<sup>5</sup> was conducted at a standardized workstation. An inclusion criterion was resting pain of less than 5. At the start of the test the patient was requested to score their resting pain, termed 'Pain before typing' on a scale of 0–10. They would then start to type a standard document at their own speed for a maximum of 30 minutes or until pain reached '5'

(0–10). After the typing test the patients again recorded the pain in each extremity on a scale of 1–10 labelled 'pain after typing', and on the PC the typing speed in words per minute (wpm) was calculated.

## Statistics

Two-tailed student T-test with *P* level at 0.05 was used for evaluation.

## Results

The 59 patients typed with an average speed of 26.4 (SD 9.7) wpm. The group of controls typed with an average of 36 (SD 3.8) wpm. The patients were divided into three groups: fast (Table 1) = patients who typed a minimum of 1 standard deviation faster than the total mean with a group average 42.4 (SD 4.9) wpm; slow (Table 2) = patients who typed a minimum of 1 standard deviation slower than the total mean with an average 13.9 (SD 1.9) wpm; and middle (Table 3) = patients who were in neither extreme.

The typing speeds were significantly different between all three patients groups (*P* < 0.05). The typing speed was significantly faster in the fastest patient group than in the control group (*P* = 0.04) and the slow and middle groups (*P* < 0.0001). The pain before typing was highest in the slowest group, in both hands but this

**Table 1**  
Fastest typing patients

Patient	Pain before typing		Pain after typing		Increase after typing		Speed (wpm)
	Right	Left	Right	Left	Right	Left	
1	3	2	5	3	3	1	40.7
2	0	0	0	2	0	2	37
3	0	0	3	0	3	0	43.3
4	0	1	0	4	0	3	42.9
5	1	0	4	0	3	0	38.5
6	4	2	2	5	-2	3	43
7	0	0	5	0	5	0	45
8	4	1	5	2	1	1	41
9	3	0	5	0	2	0	37.2
10	0	0	5	5	5	5	54
Mean	1.3	0.4	3.2	2.0	1.9	1.6	42.4
SD	1.70	0.68	1.99	2.05	2.23	1.71	4.90

**Table 2**  
**Slowest typing patients**

Patient	Pain before typing		Pain after typing		Increase after typing		Speed (wpm)
	Right	Left	Right	Left	Right	Left	
1	3	0	5	0	2	0	13.8
2	3	3	5	5	2	2	13
3	2	3	5	5	3	2	16.7
4	4	0	5	2	1	2	11.4
5	0	0	5	5	5	5	10.9
6	2	4	4	5	2	1	14.6
7	3	1	3	5	0	4	12.4
8	0	0	5	5	5	5	15
9	2	0	2	0	0	0	16.3
10	2	0	4	0	2	0	15.3
Mean	2.1	1.1	4.3	3.2	2.2	2.1	13.9
SD	1.22	1.51	1.00	2.27	1.66	1.87	1.89

difference was not statistically significant. The pain after typing was also inversely correlated with the typing speed but again the difference was not statistically significant. The pain experienced was significantly lower in the left hands compared with the right side in the fastest typing group both before typing ( $P = 0.0019$ ) and after typing ( $P = 0.001$ ). In the fast group the difference between pain before and after typing in the left hand was not significant ( $P = 0.056$ ) as was found in the right hand in all the patient groups.

## Discussion

For the test set-up we used the observation by Huey-Wen Liang *et al.*<sup>3</sup> that healthy typists do not reduce their typing speed even though they developed pain after prolonged typing. This suggests that most typists have a fixed speed that they work at and will have to completely rest in order to recover from the discomfort. As the unspecific pain experienced in the upper limbs of keyboard workers has been speculated to be caused by repetitive movements of the tendons, muscles or joints,<sup>6</sup> this would suggest that less repetitive or slower typing speed would be less painful. It was therefore a surprise that the test results in this study showed that the mean typing speed of the total group of the 59 patients tested was statistically lower than the pain-free control group ( $P < 0.05$ ). One explanation for

this, which would not disprove the hypothesis that lower typing speed is protective of WRULD, would be if an unrepresentatively fast control group had been chosen by mistake. To further investigate this question the total patient population was divided into three separate patient sub-populations based on their typing speed (fast, middle, slow) and were statistically compared. Significant differences in typing speed ( $P < 0.00001$ ) between the three groups were found. Interestingly, the fast group of patients typed statistically faster than the control group ( $P = 0.043$ ), but the slow and middle groups were statistically slower than the control group ( $P < 0.0001$ ). This would suggest that the control group was not abnormally fast in typing and that slow typing speed is not protective of WRULD, though it is possible. When analysing the experience of pain among the patient groups prior to typing two interesting trends emerge: (1) The pain decreases with increase of typing speed – but not to a statistically significant degree; and (2) the groups had more pain in the right hand than the left though this difference was only statistical in the fast group ( $P = 0.0018$ ). These two trends continued in the results after typing but again was only statistical in the fast group ( $P = 0.001$ ).

When pain levels before and after typing were compared, it transpired that all three patient groups developed a significant increase of pain in both hands except in the fast group where the pain in the left hand did not increase statistically

**Table 3**  
Intermediate speed typing patients

Patient	Pain before typing		Pain after typing		Speed (wpm)
	Right	Left	Right	Left	
1	2	2	5	5	25
2	3	0	4	0	21.2
3	1	1	5	5	20
4	0	0	5	0	25.5
5	2	0	4	0	27.6
6	1	0	5	5	29.6
7	3	3	5	5	24.2
8	4	0	5	0	19.5
9	1	1	2	2	20
10	0	0	5	0	17.6
11	0	1	0	5	28.3
12	2	0	5	0	31.4
13	0	0	0	5	22.7
14	0	2	0	3	17.8
15	0	0	5	5	19.9
16	1	1	5	5	21
17	2	0	5	0	33
18	0	0	2	1	33.2
19	1	0	4	0	21.1
20	2	3	4	5	34.8
21	4	0	5	0	22.7
22	2	3	3	4	21.8
23	0	0	1	0	27.4
24	4	0	5	0	34.5
25	2	0	1	0	35
26	0	2	0	5	23
27	3	3	5	5	12.7
28	3	0	5	0	21.8
29	1	1	5	5	25.2
30	3	0	5	0	32.4
31	0	0	5	0	36
32	2	0	4	0	20
33	3	3	5	5	24.2
34	3	3	5	5	27.4
35	0	3	0	5	19
36	2	0	3	0	29
37	3	3	4	5	31
38	0	0	5	5	28
39	2	2	5	5	20.1
Mean	1.6	0.9	3.7	2.6	25.2
SD	1.31	1.22	1.81	2.39	5.72

( $P = 0.056$ ). This finding has not been reported previously in the literature and suggests that

those who type at medium and slow speeds may be more susceptible to developing WRULD and could be caused by poor typing technique.

The opinions about how to avoid WRULD are divided as one paper suggests that adopting a slower typing speed may compensate for keyboard-induced problems<sup>2</sup> while another study showed that healthy typists who typed for long periods developed increasing pain but despite this did not reduce their typing speed<sup>3</sup> which suggest that most typists have a fixed typing speed and can only reduce their risk of WRULD by being better, not slower, at typing. Considering that few keyboard workers have had formal keyboard typing training, one can speculate if such training would be use full in keyboard workers with WRULD who have abnormally slow typing speed as part of their rehabilitation.

## Conclusion

Typing speed is not proportional to the severity of pain in keyboard workers with WRULD. Patients with statistically significant slower or faster typing speeds do not have statistically different levels of pain.

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