Use of the 'Typing Capacity Cycle' Test as an Assessment Tool for Keyboard Users with Work-Related Upper Limb Disorder

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This paper describes a 'typing capacity cycle' test (first typing period + recovery time) for keyboard users with Type II Work-Related Upper Limb Disorder. The test was implemented on both control and patient groups on a standardised VDU in a neutral location. The patients' test results showed that the typing speed and the typing endurance were not directly correlated with the required recovery period. This is a new finding. We therefore suggest that measuring the 'typing capacity cycle' represents true work capacity more accurately than recording typing speed in patients with Type II Work Related Upper Limb Disorder. Performance of a small group of Type II WRULD patients following rehabilitation is also reported.

INTRODUCTION – REVIEW OF LITERATURE

WRULD Definition

Work-related upper limb disorders (WRULD) caused by the use of visual display units (VDU) continue to cause painful conditions. Type I WRULD refers to localised, clearly defined syndromes such as Carpal Tunnel Syndrome, de Quervain's Syndrome and Lateral Epicondylitis (Ireland 1988). This is the largest group and is relatively easy to diagnose and treat. Hutson (1997) defined Type II WRULD as non-traumatic upper limb pain of unclear cause. It is far more difficult to diagnose as it is characterised by regional pain syndromes, which have vague definitions, for example regional allodynia or hyperalgesia.

An objective diagnostic tool

The difficulty in diagnosing Type II WRULD is partly due to the fact that a specific objective test is not currently available and, as a consequence, it is diagnosed on the basis of exclusions. Treatment is often delayed and therefore prolonged because of the lack of a diagnostic tool. These conditions can be career-threatening as a result of significant loss of work capacity. This is often compounded by the uncertainty of future recovery potential and the fact that response to the proposed treatment regimes is difficult to quantify. Under such circumstances some employers may be inclined to medically retire the patient rather than have them participate in lengthy rehabilitation programmes. We are not aware of any reported diagnostic tests which are simple, reproducible and cost-effective and that can assess the prospective work capacity of keyboard users with Type II WRULD in realistic test conditions. Most of the reported investigations have assessed outcome either by questionnaires, video filming or muscular force recording (Nakazawa et al 2002, Friess and Svensson 2001, Van den Heuvel et al 2003, Lindegard et al 2003, Liao and Drury 2000, Balci and Agahazedeh 2003, Ketola et al 2002). Some studies have investigated the effect of very long typing tasks, approaching two hours (Liao and Drury 2000), however, this breaches the guidance issued by the Health and Safety Executive, England (HSE 1992), where it is stated that continual typing for healthy individuals is recommended to be for periods of less than 50 minutes. It therefore seems reasonable to create a typing test for symptomatic individuals that is clearly shorter than 50 minutes.

Performance testing and rehabilitation

The literature shows that there is little evidence

demonstrating the effectiveness of biopsychosocial rehabilitation (Karjalainen et al 2000). This may be due to the lack of simple, standardised reproducible tests that measure changes in performance, endurance and perceived disability.

This paper has a dual purpose. We aim to report our experience of using a simple test for VDU users who have developed career-threatening Type II WRULD. Patients are performance-tested on referral to a specialist clinic for hand and upper limb problems, and their performance is compared with symptom-free workers. Secondly, we want to report on the performance of a smaller group of Type II WRULD patients following treatment.

MATERIAL AND METHODS

Participants

The individuals reported in this study originated from two separate sources. Six Type II WRULD individuals were patients who were referred to a specialist hand and upper limb clinic because of the development of non-traumatic upper limb pain in relation to the use of VDUs. The six control individuals were medical secretaries that were recruited from the department. Controls with a history of previous upper limb injury or pain were excluded from the study. All individuals gave consent to participate in this study. The patient group in this paper is referred to as WRULD.

The typing test

The test described below has been developed over a number of years as an attempt to create a simple, reproducible 'off-site' tool to enable hand surgeons and hand therapists to objectively assess keyboard users' work capacity after developing WRULD.

This typing test was carried out in a hand therapy treatment room at a designated desk 73cm high and 73cm deep with a designated height-adjustable chair with the use of a standard 12-inch monitor (Dell Optiplex Gxa, USA) and a standard keyboard (Dell AT102W, USA). The test did not involve the use of a mouse. Patients were instructed to use only the keyboard during the test and to ignore errors that required the use of the mouse for correction. They were at liberty to adjust the chair and the positioning of the monitor, keyboard and manuscript to suit their personal preference at that specific time. The subjects were first asked to score their resting pain, termed 'start level', on a visual analogue scale (VAS, 0-10).

They would then start to type a standard document at their own speed for a maximum of 30 minutes or until the VAS reached 5. If they managed 30 minutes the typing component of the test was considered completed. If, however, whilst typing their pain reached a VAS level of 5, they were instructed to stop typing and the length of the typing period was recorded. Following the first typing period all participants would carry out stretching exercises until the pain level returned to the start level and the time it took for this to take place was recorded. Once this had occurred those who did not manage 30 minutes in the first period would then start typing the second period until they again reached VAS 5, and this second typing period duration was also recorded. The actual and relative typing speeds, taking the length of the recovery period into consideration, were then calculated.

RESULTS

Table 1
Summary of results of the typing tests of control and patient group pre-treatment

Parameters		mean	mean	Individual patient scores					
		Control group	Patient group	1	2	3	4	5	6
START LEVEL	VAS	0	2	2	4	2	0	3	1
1st PERIOD UNTIL VAS=5	Duration (Minutes)	30	15.16	12	8	7	15	19	30
REST PERIOD UNTIL VAS= START LEVEL	Duration (Minutes)	0	6.3	13	12	3	5	5	0
2nd PERIOD UNTIL VAS=5	Duration (Minutes)	N/A	8.4	4	10	11	7	10	0
RELATIVE TYPING SPEED*	Words/ Minute	36	19.6	20	15	31	18	14	5
ACTUAL TYPING SPEED[a]	Words/ Minute	36	26.3	37.5	25	52	24.5	16.8	5

[a]Actual typing speed = calculated as the actual time spent typing.
*Relative typing speed = calculated as the time spent typing, taking the recovery period into account.

Table 2
Comparison of results of the typing cycle tests of the pre and post-rehabilitation of patients 4, 5 and 6

		4 pre	4 post	5 pre	5 post	6 pre	6 post
START LEVEL	VAS	0	0	3	3	1	1
1 PERIOD UNTIL VAS=5	Duration (Minutes)	15	30	19	25	30	30
REST PERIOD UNTIL VAS=START LEVEL	Duration (Minutes)	5	0	5	5	0	0
2 PERIOD UNTIL VAS=5	Duration (Minutes)	7	N/A	10	10	N/A	N/A
RELATIVE TYPING SPEED	Words/Minute	18	18	14	9	5	33
ACTUAL TYPING SPEED	Words/Minute	21.6	18	16.8	10.8	5	33

Table 1 shows that the group of six healthy volunteers were able to type for 30 minutes at typing speeds between 31 and 42 words per minute (mean 36) without developing pain. However, in the group of patients with WRULD, the typing endurance was significantly reduced. Only one patient could type for 30 minutes but had at that time developed a pain-severity level of VAS 5 and had only achieved a typing speed of 5 words per minute.

For the WRULD group the mean typing duration was 15.16 minutes, with relative typing speeds on average of 19.6 words per minute. When taking into consideration their rest period the actual typing speed was 26.3 words per minute. However, this implies that frequent rests are required to maintain a satisfactory typing speed.

The required recovery periods varied between 5 and 13 minutes and were on average a third of the preceding typing period. A subsequent typing period lasted on average 8.4 minutes. This is a reduction from the first typing period of 55.4%.

We were able to re-test three of the patients after a rehabilitation programme before they planned return to work. Table 2 demonstrates how two of the three individuals (patients 4 and 6) were able to type for the whole 30 minutes, one without developing pain and the other with less pain than before but with a six-fold increase in typing speed. However, although patient 5 showed an improvement in endurance it was at the expense of typing speed, despite exhausting all conservative measures.

DISCUSSION

Indications for using the typing test

The test is well tolerated by normal healthy individuals and is well within the guidelines for VDU workers in England as outlined by the Health and Safety Executive (1992). The assessment of the control group shows that the test is unlikely to cause pain in pain-free individuals. Individuals with WRULD who had pain at the outset of the test, and who did not exceed 30 minutes of typing or increase their pain to a maximum of VAS 5 before they stopped typing, did not have any long-lasting increase in pain.

Observations and new findings

Table 1 demonstrates VAS scores that were greater than 5 at the end of the typing test even though participants were aware they had to stop typing before reaching that stage. Patients stated that the full extent of the pain is often not experienced until after the typing has ceased. During a standard eight-hour working day, these individuals would therefore have to be more disciplined in taking regular breaks to minimise the occurrence of high pain levels.

An interesting trend was observed with regards to the 'work capacity cycle = first typing period + required recovery time' in that the less time the patient could type for before the pain reached VAS 5, the longer it took for the pain to return to the start level. This suggests that those with severely impaired typing endurance also have an impaired recovery capacity – therefore having a 'double negative impact effect' on their work capacity. To our knowledge this observation has not been made in previous papers on WRULD in patients with keyboard work, and suggests that any test on work capacity should also incorporate the required recovery period. We examined the second typing period and observed that this was further reduced when compared to the first typing period despite having a long recovery period and having returned to the initial resting pain level. This finding was further emphasised when we investigated the performance of the three patients who were tested before and after treatment. This suggests that rehabilitation of patients with WRULD may result in combinations of improved typing endurance, typing speed or recovery capacity – thereby creating a 'single, double or triple positive impact' effect.

REHABILITATION

Discussion

A diagnosis of WRULD does not in itself determine a treatment approach as it encompasses a wide variety of pathology and symptom presentation. The nature of any therapeutic intervention should therefore relate specifically to how the individual presents in terms of their present level of functional ability, lifestyle, pain distribution, posture, strength and upper quadrant movement patterns (Keller et al 1998). Pursuit of a sedentary lifestyle and the limited experience of being exposed to the feeling of normal body movement patterns and postural techniques was a common trait amongst the patients in this study. Our primary role has been to motivate and encourage the patient to gain control of their symptoms by learning about posture and normal movement patterns. This enabled patients to identify areas of the body or upper quadrant that were under strain and required immediate attention to counteract the effects of prolonged static positioning and limited normal movement patterns. Once empowered with this knowledge they proved to be better equipped to incorporate other aspects of the treatment regime. The fear of the possible damage to one's career as a result of WRULD

can hinder treatment, as patients will tend to work through pain in order to remain productive. Support and advice in dealing with conflicts at work while recovering was an important aspect of the treatment. We attempted to promote a strong work ethic, so as to ensure successful re-entry into the work place after prolonged absence.

Treatment approach

The treatment methods used in this study are a combination of those recommended in the literature (Keller et al 1998, Fowler et al 2000). A three-phase programme was adopted to pace the treatment. Phase I symptom control, Phase II strengthening and Phase III conditioning.

Treatment sessions occurred on a one-to-one basis with an occupational therapist. Splints were not advocated as they interfere with muscle re-balancing, strength, soft tissue alignment and joint or bone composition (Fowler et al 2000). The first phase of treatment included education, postural retraining, body movement awareness, ergonomics and techniques for managing pain; for example the use of thermal modalities, massage of soft tissue, joint mobilisation and gentle stretching. Patients were encouraged to limit caffeine and nicotine intake and increase light aerobic exercise. If there was proximal neurovascular compromise, nerve-gliding techniques were used. A diagrammatic home exercise programme was issued, designed to increase circulation, reduce stiffness or cramping and encourage normal movement patterns. The second phase of treatment commenced once the patient had gained control of their symptoms and involved a strengthening programme to re-balance muscles and improve joint function, soft tissue extensibility, muscle tone and nerve mobility. Patients were taught to adapt to neurovascular changes to decrease the risk of injury. The final phase of treatment is a conditioning phase aimed at maintaining the new health-promoting lifestyle and the application of the correct principles during a working day. The support, empowerment and encouragement to adopt health-promoting behaviour had a positive impact on the patient's ability to return to work.

CONCLUSION

The authors acknowledge the fact that the number of participants in this study is small, but to our knowledge a larger similar study of this nature is not available. However, this small study has revealed encouraging results. The method used for the rehabilitation of these patients suggests that a larger study of Type II WRULD should be conducted, using the typing test as an assessment tool and predictor of work capacity followed by a rehabilitation programme. The typing test is also very useful when re-evaluating work capacity at a later stage.

We therefore advocate that the described typing test is a simple, reproducible, safe and cost-effective method of investigating the 'typing capacity cycle'. It would seem appropriate to use this test for both clinical and future research purposes in larger studies. The results found in this paper may also provide future studies with a framework to compare the efficacy of different methods of treatment for WRULD.

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