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Case example of wrist trauma in keyboard use

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Evidence of injury to the pisiform and dorsal sensory branch of the ulnar nerve in a video display terminal (VDT) operator is presented. The subject has performed data entry work via keyboard for 20 years and has the common habit of resting her wrist against the leading edge of the keyboard. Skin lesions have been observed in other keyboard operators who similarly support their limbs. The opportunity for this type of trauma has gone unreported (and apparently unrecognised) in the ergonomics literature, which generally advocates wrist support to reduce upper extremity fatigue and improve wrist-hand posture. The present case study indicates a need for further evaluation of the dynamics of wrist rest use and of the design of support systems such that forces acting upon the wrist or palm can be controlled. Suggestions are offered in this regard.

Keywords: Keyboards, visual display units, wrist

Introduction

It is generally presumed that wrist rests can help combat stress in the neck-shoulders arising from the static efforts of supporting the arms and hands during video display terminal (VDT) keyboard operation. Indeed, VDT operators are commonly observed to rest their palms or wrists against the forward surface of the keyboard or against the table top during pauses from keying. Based upon empirical study, Hunting *et al* (1980) concluded that " . . . hands and forearms (of VDT users) are rested if there is good opportunity!" (p 182). Hunting *et al* (1980) also found reduced hand and forearm impairment when rests were used, and cited this effect as support for " . . the general requirement of providing keyboards with an adequate device giving the operator the opportunity to rest hands and forearms " (p 182). Bendix and Jessen (1986) found a preference for wrist rests in typing, but no evidence (EMG) of reduced muscle load. We have observed efforts to rest the limbs even when the opportunity is poor (Sauter and Knutson, 1984), and have also found that (depending upon the nature of the task and keyboard) some operators are capable of keying without lifting the palms or wrists from a support surface. Wrist rests may also serve to minimise hand extension in keyboard use, a suspected etiologic factor in the development of carpal tunnel disorders.

Expectations of improved comfort from the use of wrist rests are evidenced by the increasing availability of such products in the marketplace, and by their recommendation in numerous writings on VDT ergonomics (Anon, 1983a, 1985a; Cakir *et al*, 1980; Galitz, 1984). Other sources recognise potential benefits of wrist rests, but are more qualified in recommending their application (Anon, 1983b, c; 1985b).

Considering the increased attention to wrist rests in VDT use, it is somewhat surprising that there has been little discussion of appropriate wrist rest design. Specifications for parameters other than the depth of the support area in front of the keys/keyboard are difficult to find. Nor has there been much study of the dynamics of wrist rest use and the influence of various designs on comfort and acceptance, though the recent work of Nakaseko *et al* (1985) and Bendix and Jessen (1986) are important exceptions. In this regard, we raise the concern that depending upon their geometry and surface characteristics, keyboards or separate wrist/palm rests could present a risk to the user for trauma in the wrist and hand.

Case report

In a clinical ergonomics programme for follow-up and remediation of health complaints among VDT users, two of 78 cases investigated thus far involved wrist irritation associated with wrist rest use. (Two others consisted of elbow irritation from resting the arm upon the table.) The more notable of the two wrist cases involved a data entry operator with inflammation and tenderness at the ulnar border of the right hand in an area surrounding the pisiform bone (Fig. 1). Pain which radiated from the heel of the palm around the outside of the hand to the back of the little, ring and middle fingers of the hand was also experienced.

This work was performed at the Department of Preventive Medicine, University of Wisconsin. This report does not necessarily reflect the views of The National Institute for Occupational Safety and Health.

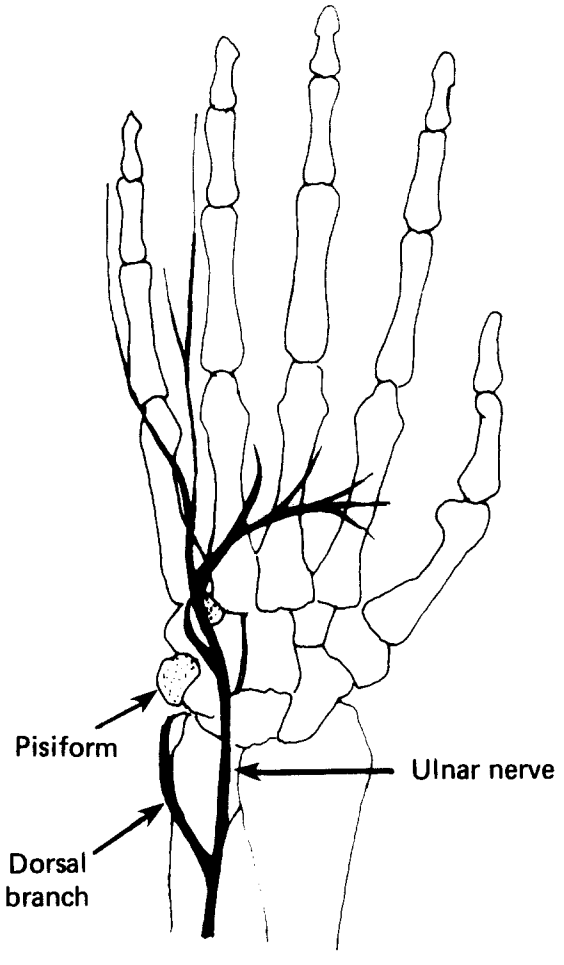

Fig. 1 Palm view of the right hand

Upon examination, the pisiform was found to be enlarged, suggesting the development of a small ganglionic bone cyst or calcific mass over the pisiform. Fig. 2 shows the palmar surface of the right hand at the wrist crease in this individual. The tissue around the pisiform is compressed to show its proliferation. We measured the pisiform projection in the right hand to be about 3 mm in excess of that in the left hand. The distribution of the radiating pain is consistent with a lesion of the dorsal sensory branch of the ulnar nerve. (Figs. 1 and 3 show the dorsal and other branches of the ulnar nerve.) There was no evidence of sensory or motor loss, or muscle wasting in any part of the hand.

The subject is a 37-year-old woman who began working intermittently as a data entry operator in 1966 using an electro-mechanical keypunch. Irritation in the area of the pisiform occurred soon after beginning work. However, by her report, the discomfort and abnormal development at the pisiform has advanced since the late 1970s. At that time she began steady data entry work using a VDT keyboard. It was not until the spring of 1985 that she developed the radiating pain over the back of the hand. She reported no similar pisiform asymmetry in her relatives, nor prior trauma to her wrist. Neither irritation nor abnormal appearance of the pisiform were noticed prior to the onset of work as a data entry operator. At present, her discomfort mounts over the course of the week to the point where homemaking tasks are affected, although improvement is noted with a few days of rest.

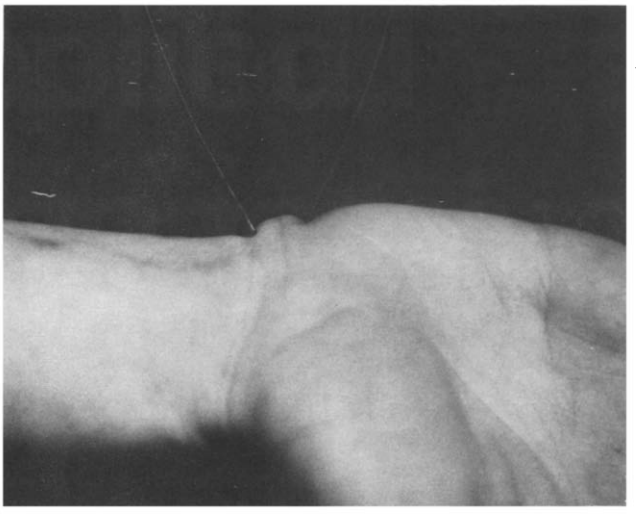

Fig. 2 The projection of the pisiform

Discussion

Close observation of the posture of typists' hands when they are rested upon the keyboard or wrist rest suggests a biomechanical basis for these disorders. Typically, the hands are rested in a semi-prone posture, bringing the ulnar border of the palm or wrist into contact with the support surface. Fig. 4 shows the resting hand posture of the present subject.

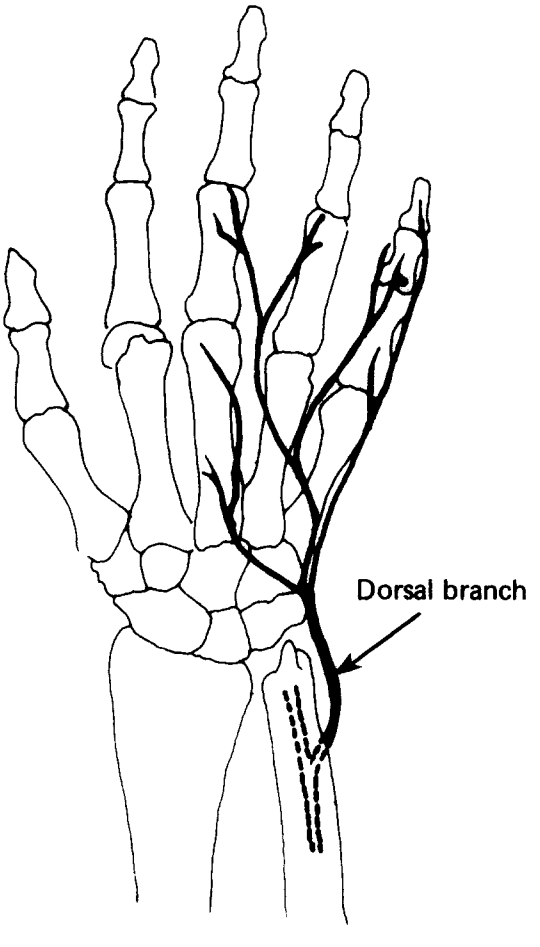

Fig. 3 Dorsal (top) view of the right hand

Fig. 4 Contact of the wrist with the leading edge of the keyboard

The arrow drawn on her wrist marks the position of the pisiform. As seen, it contacts the rear edge of the keyboard. The subject has used this keyboard since the late 1970s when her wrist problems accelerated. Also, as is evident in Figs. 1 and 3, the dorsal sensory branch of the ulnar nerve may be vulnerable in this area. The location at which the branch wraps around the ulna to become dorsal is usually several centimetres proximal to the head of the ulna, but not infrequently it is more distal, sometimes even distal to the ulnar head (Kaplan, 1963). According to Jabre (1980), the dorsal branch can be easily traumatised at this point when the forearm is rested against a sharp surface such as the edge of a table or desk. It is plausible that the wrist disorders in the present subject are the result of repetitive trauma to the pisiform and ulnar dorsal branch caused by the resting or repeated percussion of the wrist against the leading edge of the keyboard. Indeed, she performed a very stereotypic task in which the right hand repeatedly rocked over the leading edge of the keyboard.

While it is clear that the design and use of the keyboard as a wrist rest exacerbates the hand disorders in the case described here, the complete etiological picture cannot be known. It is uncertain whether the ulnar pain and pisiform development are directly related to the keyboard contact,[1] or whether they have been influenced by a pre-existing peculiarity of the pisiform or other condition of this subject. The literature provides little reference to similar cases. Phalen (1952) reported a case of calcified pisiform bursitis of unknown origin in a secretary. Helal and Vernon-Roberts (1976) described a pisiform ganglion with sensory deficits in the area served by the dorsal branch of the ulnar nerve. The subject was a secretary, but the effects were precipitated by a minor fall. Stopford (1922) described two cases of ulnar dorsal branch lesions brought on by tight wrist watch bands.

[1] Both may have been independently caused by keyboard contact, or the ulnar lesion may be secondary to the pisiform trauma. However, the latter explanation would imply that the dorsal branch of the ulnar nerve and the pisiform are more contiguous in this subject than is commonly the case.

Conclusions

It would be inappropriate at this time to suggest that a significant risk exists among VDT operators for the types of hand disorders reported here because their etiology cannot be fully established. On the other hand, it must be considered that exposure of the wrists of keyboard operators to supports has probably been minimal to date. The great majority of VDT operators have not used wrist rests, and the designs of many VDT or typewriter keyboards do not permit the resting of the hands. It must also be noted that the hand disorders in the present subject required nearly two decades to develop to the point where intervention was sought. On balance, we feel the present case report and the potential mechanisms of wrist-hand trauma described here warrant a cautionary note, particularly considering the widespread recommendation and increasing use of wrist rests.

From the standpoint of prevention, one self-evident design principle is that the rest should not present sharp pressure points to the wrist. In this regard, it would seem advisable for the forward edge of the keyboard or wrist rest to be gently contoured, and/or for the surface to be lightly padded. (To this end we have observed VDT users to affix a thin layer of polyurethane foam to their keyboards, or utilise a firm, thick foam pad as a wrist rest.)

It has been advised that the support area before the keys be at least 5 cm deep (Cakir *et al*, 1980). However, Nakaseko *et al* (1985) found that larger wrist-forearm rests are both preferred and more effectively utilised (as measured in terms of forearm pressure exerted upon the rest). The possibility of compression of the wrist in vulnerable areas surrounding the wrist crease as caused by contact with the leading edge of the support would also be reduced with large rests (though this may not be much of an issue if the rests are padded and the edges contoured). In Fig. 4 the margin for support in front of the keys is of the order of the 5 cm recommendation, yet the wrist is traumatised. The preferred rests in the Nakaseko study (1985) extended 28 cm before the home row. The leading edge of a wrist rest of this size would be several centimetres proximal to the point at which the dorsal branch of the ulnar nerve separates from the main trunk and courses around the ulna (3–8 cm proximal to the ulnar head).

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