Ergonomic Mouse

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Introduction

Use of a computer mouse accounts for 30-80 percent of all time spent working at a computer (Dennerlein and Johnson 2006). Prolonged use of a computer mouse has been linked to musculoskeletal disorders that include carpal tunnel syndrome, tendonitis and De Quervain's tenosynovitis.

De Quervain's tenosynovitis, also known as radial tenosynovitis, is an inflammation of the tendon or tendon sheath at the base of the thumb where it connects to the wrist. Repetitive activities that move the wrist in ulnar deviation (the direction of the small finger), like using a computer mouse can cause swelling, and pain at the base of the thumb. The tendons that pull the thumb away from the fingers (into the "hitch-hiking" position) become inflamed and irritated as they pass beneath the ligament that holds the tendons to the bone at the wrist (ASSH 2009).

Carpal Tunnel Syndrome (CTS) develops as a result of pressure on the median nerve at the wrist. The carpal tunnel is an anatomical space through which the median nerve and nine tendons pass from the forearm to the hand. CTS occur when there is an increase in pressure within the tunnel. This pressure compresses the nerve causing numbness, tingling and pain in the hand and fingers. Prolonged posture and repetitive finger and wrist motion have been linked to the development of CTS (ASSH 2009).

A series of studies by Johnson et al (1993, 2000, and 2002) identified prolonged force application and sustained posture in computer mouse use as a risk factor for development of musculoskeletal disorders. Specifically, standard mouse use places the hand in a position of prolonged and extreme ulnar deviation and wrist extension. Over the last decade various mouse designs have emerged in the marketplace to address this problem. These include trackball designs, joysticks, vertically oriented mice, and touch control. Additionally, changes in mouse placement and position (to the center or left of the keyboard) have been advocated in an attempt to alter the forces generated in the standard mouse position to the left of the keyboard (Dennerlein 2006). Several studies examine the effects of different mouse designs on wrist posture and finger force with inconclusive results (Chen 2007, Hengel 2007, Burgess-Limerick 1999). As an example, use of a trackball has been found to reduce the risk of extreme ulnar deviation while increasing the risk of extreme wrist flexion (Burgess-Limerick, 2007).

Current Situation

OSHA reports that RSI incidence has reached such epidemic proportions that RSI represents 62 percent of all North American Workers Compensation claims, and results in $15-$20 Billion in lost work time and WC claims each year (PR Newswire, January 18, 2005).

Furthermore, the Bureau of Labor Statistics (2005) reports that 26 million Americans suffer from RSI with 1.8 million having injuries severe enough to require a worker to miss at least one day of work. Topping the list for the median number of days workers are sidelined is carpal tunnel syndrome, which causes injured workers to be out of work an average of 28 days.

To date there is no one design that addresses all the problems encountered with prolonged positioning in using a mouse. Furthermore, all the current designs in the market alter the static position, by substituting with another static non-adjustable position. These solutions simply place the user's hands in what is believed to be a more "natural" position. Additionally, there is no conclusive evidence supporting one design over the other. .

These factors suggest that a possible solution would include an ergonomic mouse that has the capacity to alter position in both radial/ulnar deviation and wrist flexion/extension. Such a device would avoid prolonged posture in any one position, and thus minimize the cumulative effects of repetitive use. In addition, the ability to self-select a comfortable posture, and allow for adjustments during computer work would minimize the strain created by prolonged positioning. By adapting and conforming to the natural position of the hand and wrist during movement, this mouse will allow for increased use and greater productivity while eliminating interfering symptoms.

Summary

Any device that can incorporate all of the conditional factors now recognized as being causative of RSI and CTS should have the ability to dramatically reduce the incidence of such injuries.

They would have to therefore:

- Allow for periodic re-positioning of the hands and wrists
- Provide such movements in two degrees of freedom: wrist flexion/extension and radial/ulnar deviation.
- Provide positioning that is significant enough to provide benefit without being extreme
- Provide intelligent evaluation of each user and allow for self selection of comfortable posture
- Provide a superior comfort level in all positions made available by the device

It is our hope that such intelligent and healthy movement-based devices will find their way into the market so that as many people as possible can receive the benefit of minimizing their risk of Repetitive Stress Injury or Carpal Tunnel Syndrome.

References:

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