



# *Is contact stress a real issue for office workers?*

## *Wellnomics® White Paper*

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## Introduction

The term 'contact stress' has recently been used extensively in some widely available documents<sup>1</sup> as pertaining to computer use and identified as a significant injury risk factor for computer users.

Contact stress is defined in the OSHA Computer workstations eTools (2003) document as

*“Internal stress occurs when a tendon, nerve, or blood vessel is stretched or bent around a bone or tendon. External contact stress occurs when part of your body rubs against a component of the workstation, such as the chair seat pan or edge of the desk. Nerves may be irritated or blood vessels constricted as a result.”*

The significance of contact stress as a major risk factor for computer users is questioned and a review of the literature was undertaken in an attempt to clarify this issue.

## Search strategy

A literature search was performed using the following online search tools and with the search terms 'contact stress' and 'local mechanical stress'.

- Oxford Journals <http://ije.oxfordjournals.org/>
- Lawrence Erlbaum Associates (LEA) <http://www.leaonline.com>
- Occupational and Environmental Medicine online <http://oem.bmjournals.com/>
- PEDRO <http://www.pedro.fhs.usyd.edu.au/index.html>
- SUMSearch <http://sumsearch.uthscsa.edu/>
- PubMed <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>
- Scandinavian Journal of Work Environment and Health <http://www.sjweh.fi/index.php>
- Taylor & Francis <http://journalsonline.tandf.co.uk>
- Wiley Interscience <http://www3.interscience.wiley.com/cgi-bin/home>
- Elsevier ScienceDirect <http://www.sciencedirect.com/>

## Results

In total these search tools identified 984 articles. The majority of articles (811) were found on the Science Direct tool and there was one duplicate. The majority of the matches were with respect to engineering, materials processing and surgical prosthetics. Six articles were identified as being relevant to work and musculoskeletal disorders. One book was identified from the author's own reference collection as having possible relevance and one more article was sourced from this book. One additional article from the author's own collection was identified as relevant whilst not containing the specific search term. These articles<sup>2</sup> are discussed in further detail below.

Roquelaure, Y., Mariel, J., Fanello, S., Dano, C., Bureau, D. Leclerc, A., Moisan, S. & Penneau-Fontbonne (2004). Surveillance program of neck and upper limb musculoskeletal disorders: assessment over a 4 year period in a large company, *Annals of Occupational Hygiene*, 48, 7, 635-642

This paper discusses a method of surveillance used to ascertain the exposure of workers in a large shoe manufacturing company to risk factors for musculoskeletal disorders. Local mechanical contact stress of the finger, palm, elbow and armpit was used as part of the checklist for risk factors. This work under investigation has little relevance to computer use as it involves medium to heavy physically demanding, manual manufacturing tasks.

**Roquelaure, Y., Mariel, J., Fanello, S., Boissière, J-C Chiron, H., Dano, C., Bureau, D. & Penneau-Fontbonne, D. (2002). Active epidemiological surveillance of musculoskeletal disorders in a shoe factory, *Occupational & Environmental Medicine*, 59,452-458**

This paper reported on the same investigation as the reference above.

**Marcus, M., Gerr, F., Monteilh, C., Ortiz, D.J., Gentry, E., Cohen, S., Edwards, A., Ensor, C. & Kleinbaum, D. (2002). A prospective study of computer users: II. Postural risk factors for musculoskeletal symptoms and disorders, *American Journal of Industrial Medicine*, 41:236-249**

This article reports on a large prospective epidemiological study of computer users. Whilst not specifically referring to 'contact stress' it included 'presence of a sharp leading edge' in the assessment of postural exposures for hand arm/symptoms and disorders. The analysis did not identify this factor as being associated with an increased risk of hand/arm symptoms or disorders.

**Keir, P.J. & Wells, R.P. (1999). Changes in geometry of the finger flexor tendons in the carpal tunnel with wrist posture and tendon load: an MRI study on normal wrists, *Clinical Biomechanics*, 14, 9, 635-645**

This investigation aimed, in part, to calculate the radius of curvature of the flexor tendons and note implications for contact forces on the median nerve. MRI imaging was performed on 3 participants while their wrists were splinted in four wrist postures. The conclusions made were that

*“The addition of tendon force with the wrist flexed acts to reduce the radius of curvature which further increases the contact stress on the median nerve and other wrist structures.”*

In this investigation contact stress was defined as an internal event and was wholly associated with a wrist flexed position. This study emphasises the important practical point of maintaining neutral wrists positions when working. This point is well accepted as best practice based on the current evidence.

**Fransson-Hall, C, Bystrom S, Kilbom A. (1995). Self-reported physical exposure and musculoskeletal symptoms of the forearm-hand among automobile assembly-line workers, *Journal of Occupational & Environmental Medicine*, 37, 9, 1136-44**

This study examined the prevalence of physical exposures and symptoms of the forearm and hand in highly repetitive jobs on an automobile manufacturing assembly-line. Contact stress of the hand was identified as a risk factor in this environment.

**Hagberg, M., Silverstein, B.A., Wells, R.V., Smith, M.J., Hendrick, H.W., Carayon, P. and Perusse, M. (1995). *Work related musculoskeletal disorders: a reference book for prevention* Kuorinka, I and Forcier, L (eds), London: Taylor & Francis**

This book includes contact stress under the term 'local mechanical stresses' and explains:

*“Whenever there is contact between the body and external objects, mechanical stresses on tissues should be considered. Local stresses can cause injury to the skin and underlying*

*structures, most commonly nerves, bursae and blood vessels. Common areas of consideration include the hand, wrist elbow, shoulder and knee” (p. 142-143)*

The section then follows on to describe possible injuries with examples from scissors, hand tools, pushing over the carpal tunnel with the wrist extended, leaning on the elbow in a flexed position, carrying heavy loads on the shoulder. One reference cited in this book section is related to computer use. This is discussed below.

**Sauter, S.L., Chapman, L.J., Knutsen, S.J. & Anderson, H.A. (1987). Case example of wrist trauma in keyboard use, *Applied Ergonomics*, 18, 3, 183-186**

This article presents a case study of a computer operator with the habit of resting her wrist against the leading edge of the keyboard. She experienced an injury to the pisiform and dorsal sensory branch of the ulnar nerve. The article also reported that skin lesions had been observed in other keyboard operators who similarly support their limbs. The aim of this article was to highlight the possibility that these types of problems may occur and to provide warnings and advice for the design and use of keyboards and wrist rests. At the time of publication (1987) it notes that the majority of Visual Display Terminal (VDT) operators have not used wrist rests and the design of VDT keyboards or typewriter keyboards do not permit resting of the hands. The conclusions assert that

*“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 can not be fully established.”*

They go on to state:

*“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”.*

The authors recommend that any wrist or forearm supports do not present sharp pressure points to the wrist and that larger wrist-forearm supports are considered. Though this report is now dated the recommendations for larger forearm support is in agreement with current opinions regarding the benefits of forearm support during keyboard and mouse use (e.g. Cook & Burgess-Limerick, 2004<sup>3</sup>, Marcus et al, 2002<sup>4</sup>).

## Conclusions

1. Whilst contact stress is a fairly well identified risk factor for musculoskeletal disorders in medium to heavy, repetitive, manual job tasks there is no evidence to suggest it is a significant risk factor for computer users.
2. It is plausible that discomfort could occur from contact on sharp edges but the current literature does not support this as being associated with the development of musculoskeletal symptoms or disorders.
3. Whilst it is obviously prudent to control any possible sources of contact on sharp edges with product design and optimal techniques this is unlikely to have a strong impact on preventing or controlling incidence of computer related pain conditions and absenteeism.

## References

<sup>1</sup>OSHA (2003) Computer workstations eTools  
<http://www.osha.gov/SLTC/etools/computerworkstations/index.html>

<sup>2</sup>Two articles are not able to be sourced until January, 2006

<sup>3</sup>Cook, C. & Burgess-Limerick, R. (2004). The effect of forearm support on musculoskeletal discomfort during call centre work. *Applied Ergonomics* 35, 337-342

<sup>4</sup>Marcus, M., Gerr, F., Monteilh, C., Ortiz, D.J., Gentry, E., Cohen, S., Edwards, A., Ensor, C. & Kleinbaum, D. (2002) A prospective study of computer users: II. Postural risk factors for musculoskeletal symptoms and disorders, *American Journal of Industrial Medicine*, 41:236-249