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## **HAND POSITIONS IN SCROLLING, AS RELATED TO PC-WORKERS' DYSTONIA, AND TREATMENT OF DYSTONIA BY MEANS OF VIBROSTIMULATION AND EXTERNAL SHOCK WAVES THERAPY**

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Recently, an interesting study was brought forward, concerning the distinguishing of our body from not-body devices <sup>1</sup>. In using the computer, the computer mouse may be regarded as such a device that is experienced as part of our body sometimes, especially in relation to hand and fingers. In handling the computer mouse however, hand and finger will always try to follow their own characteristic kinematics. It is not surprising therefore, that various upper extremity dysfunctions emerged, together with the increasing popularity of the PC. This coincidence may become even more relevant, also in view of the still growing computer use by e.g. the elderly <sup>2</sup>. In the next survey, some frequent hand and finger dysfunctions related to mouse scrolling will be dealt with, mainly based on our specific knowledge of finger anatomy and kinematics.

Nowadays it is generally accepted that, preceding peripheral dystonia of hand and fingers, complaints of peripheral neuropathy may be experienced too <sup>3</sup>. Such dystonia includes disturbed muscle tension balances, leading to painful, impaired and often aberrant motions <sup>4</sup>. Dystonia associated with PC work is a relatively un-known disorder for most occupational health staffs however, as a consequence of which these complaints are treated as a cervicobrachial disorder <sup>5</sup>.

Various studies stressed the vulnerability of the elbow region during PC work, by which the ulnar nerve passing this region may eventually be compressed, thus leading to a peripheral ulnar neuropathy <sup>6</sup>. Several authors even do regard this as the pathogenesis of peripheral dystonias <sup>7</sup>. In order to avoid such a sombre scenario, it may be useful to analyse the kinematical sequels of this ulnar neuropathy - in other words: what happens if the ulnar nerve loses part of its motor function? To understand this, one should keep in mind that most of our small muscles moving the fingers are provided by the so called deep branch of the ulnar nerve. Especially these muscles may be affected, in ulnar neuropathy. Eventually, the so called ulnar-minus position of fingers may be the result, characterised by abundant flexion of the two distal joints of the finger, simultaneously with an over-extension of its main knuckle joint. A thorough static analysis of such a claw-finger was already published many decades ago, long before PC's came into view <sup>8</sup>. But surprisingly, this ominous position has now also been presented in a recent ergonomic study on mouse scrolling <sup>9</sup>. A kinematical analysis of this situation - in ulnar-minus fingers, flexion of the distal joints is ahead of flexion of the proximal joints - has been published that same year <sup>10</sup>.

Some words on prevention and therapy should necessarily conclude this short survey. In fact, it looks as though repetitive motions of our hand, when handling the computer mouse by moving the wrist sideward, gradually leads to some hypertrophy of wrist flexor muscles at the elbow, which in some cases may cause ulnar nerve compression neuropathy in this region <sup>11</sup>. Temporarily stopping such movements would be helpful in preventing the deterioration of this neuropathy into a peripheral upper limb dystonia <sup>12</sup>.

Finally, in cases of small hand and finger muscle dystonia, positive therapeutic results were quite recently obtained by the application of local vibration therapy <sup>13</sup>. Comparable results had already been registered before, in our research group, with regard to pain and muscle weakness, in occupational upper limb repetitive strain injuries by vibrostimulation therapy <sup>14</sup>.

Surprisingly, a much comparable secondary hand dystonia, closely related to the well known so called writer's cramp was recently successfully treated with the help of external shock waves therapy. The same mechanisms as by application of local vibration therapy appear to be effective. The authors, performing a study in 6 patients, suggest direct effects of safe low energy shock waves applied to the affected extrinsic and intrinsic hand muscles, to be responsible for decreasing dystonic movements and diminishing pain - all this without any muscle weakness <sup>15</sup>.

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### **REFERENCES**

- 1) De Preester H, Tsakiris M (2009) Body-extension versus body-incorporation: Is there a need for a body-model? *Phenomenology and the Cognitive Sciences*, 8, 3, 307-309.
- 2) van Boxtel MPJ, Slegers K, Jolles J, Ruijgrok JM (2007) Risk of upper limb complaints due to computer use in older persons: a randomized study. *BioMed Central Geriatrics*, 7, 21.
- 3) Charness ME, Ross MH, Shefner JM (1996) Ulnar neuropathy and dystonic flexion of the fourth and fifth digits: clinical correlation in musicians. *Muscle and Nerve*, 19, 431-437.
- 4) van Zwieten KJ, Lambrichts D, Nackaerts K, Hauglustaine S, Schmidt KP, Bex GJ, Mewis A, Duyvendak W, Narain FHM, Lamur KS, Lippens PL, Zinkovsky AV, Sholukha VA, Ivanov AA, Potekhin VV, Piskun OE, Varzin SA, Zoubova IA (2008) Lower arm and hand muscles in focal dystonias - some anatomical and therapeutic aspects. In: Varzin, S.A. & Tarasovskaia, O.E. (Ed.) *Transactions of the 3rd All-Russian Scientific Practical Conference with international participants: Health as the basis of human potential: problems and how to solve them?* November 25-27, 2008, Saint-Petersburg State Polytechnical University, Saint-Petersburg, Russia, 353-363.
- 5) Tamagawa A, Uozumi T, Tsuji S (2007) Occupational dystonia associated with production line work and PC work. *Brain and nerve (Shinkei kenkyu no shinpo)*, 59, 6, 553-559.433

6) Kahan NJ (2002) Technique addresses computer related RSI. *Occupational Medicine Clinical Care Update*, 8, 17, 1-3. 7) Girlanda P, Quartarone A, Picciolo G, Battaglia F, Gambardella C, Messina C (2007) Pathogenesis of peripheral dystonias: Polygraphic EMG recording and re-ciprocal inhibition study in ulnar neuropathy. *Electroencephalography and clinical neurophysiology*, 103, 1, 91. 8) Mulder JD, Landsmeer JMF (1968) The mechanism of claw finger. *Journal of Bone and Joint Surgery*, 50B, 3, 664-668. 9) Lee DL, McLoone H, Dennerlein JT (2008) Observed finger behaviour during computer mouse use. *Applied Ergonomics*, 39, 107-113. 10) van Zwieten KJ, Lippens PL, Gelan J, Adriaensens P, Schmidt KP, Thywissen C, Duyvendak W (2008) Coordination of interphalangeal flexion in the human finger. *Journal of Hand Surgery - British and European Volume*, 33, 1, 170-171. 11) Joshi SD, Joshi SS (2002) Study of cubital tunnel. *Journal of the Anatomical Society of India*, 51, 2, 173-175. 12) van Zwieten KJ, Schmidt KP, Bex GJ, Duyvendak W, Lippens PL, Varzin SA, Zinkovsky AV, Zoubova IA, Piskun OE (2009) Misfingering by instrumentalists used as a paradigm for focal dystonia in PC workers. In: Knowledge for Growth, FlandersBio's annual life sciences convention, Thursday 7 May 2009 - ICC Ghent. Focus: Trends and New Markets in Life Sciences. 13) Rosenkranz K, Butler K, Williamon A, Cordivari C, Lees AJ, Rothwell JC (2008) Sensorimotor reorganization by proprioceptive training in musician's dystonia and writer's cramp. *Neurology*, 70, 304-315. 14) Nackaerts K (2006) Whole body vibration as an adjuvant therapy for treating repetitive strain injury (RSI). MSc Thesis in Physical Therapy, Provinciale Hogeschool Limburg, Departement Gezondheidszorg, Opleiding Kinesitherapie, Hasselt. 15) Trompetto C, Avanzino L, Bove M, Marinelli L, Molfetta L, Trentini R, Abbruzzese G (2009) External shock waves therapy in dystonia: preliminary results. *European Journal of Neurology*, 16, 517-521.434