

## **Misfingering by Instrumentalists used as a Paradigm for Focal Dystonia in PC Workers**

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Misfingering by focal dystonia in PC workers not only leads to decreases of their productivity, but also to sombre perspectives of their health, due to prolonged periods of illness. In order to study these phenomena of keyboard misfingering, as well as finger disturbances during computer mouse scrolling, the misfingering by musical instrumentalists suffering from focal dystonias was used as a paradigm. Archive footage of the use of the hands in such patients served as a source of information on finger movement patterns, in keyboard, string and wind instrument players. Functional-anatomical finger modelling was then used to explain most of their symptoms. Focal dystonia includes disturbed muscle tension balances, leading to painful, impaired and often aberrant motions. In their attempts to still maintain a stabilized finger-arch, musicians suffering from focal dystonia roughly display two different patterns. First, fingers may be curled up, with interphalangeal joints flexed, and metacarpophalangeal joints extended or even hyperextended. This position is known as intrinsic-minus, referring to decreased actions of intrinsic hand muscles. Second, fingers may be stretched out quite straightforwardly, with interphalangeal joints extended and metacarpophalangeal joints more or less flexed. This position is called intrinsic-plus, referring to the vivid intrinsic hand muscle activities occurring together with extrinsic hand muscle activities. In both cases, representing the extremes, there is a stabilisation of the finger, be it an unwished one, as the fingertip will not strike the key properly but rather slips aside, or even does not touch it at all. It is hypothesized, that the disturbed muscle tension balance which characterizes focal dystonias, does include a predominance of either the extrinsic or the intrinsic hand and finger muscle activities. In order to normally display the well-known stabilized, slightly arched positions of the fingers, finely dosed activities of both groups of hand muscles are needed. Our finger kinematical model clearly demonstrates their actions in the various static and dynamic finger positions. The intrinsic-minus position however exaggerates the finger-arch (the curling-up of the finger) whereas the intrinsic-plus condition flattens the arch too much (the straightforward pointing of the finger). Finally, concomitant abduction of fingers IV and V caused by abundant intrinsic hand muscle activity can be frequently seen in focal dystonia of the hand in musicians. This involuntary spreading

of fingers once more contributes to misfingering. Comparable mechanisms occur in PC workers' hands. To understand and possibly prevent their dystonias, analyzing typical movement patterns in instrumentalists thus may be useful.