

Liste-40

HISTORY AND PROBLEMS ASSOCIATED WITH FES-STANDING IN PARAPLEGIA

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Prolonged immobilization, such as occurs after the spinal cord injury (SCI), results in several physiological problems. It has been demonstrated that the standing posture can ameliorate many of these problems. Standing exercise can be efficiently performed by the help of functional electrical stimulation (FES). The first application of FES to a paraplegic patient was reported by Kantrowitz in 1963. It was later shown by our group that standing for therapeutic purposes can be achieved by a minimum of two channels of FES delivered to both knee extensors.

The properties of the stimulated knee extensors (maximal isometric joint torque, fatiguing, and spasticity) were not found as sufficient conditions for efficient standing exercise. According to our studies, the ankle joint torque during standing is the only parameter which is well correlated to the duration of FES assisted standing. For good standing low values of the ankle joint torque are required. To minimize the ankle joint torque the lever belonging to the vertical reaction force must be decreased. Adequate alignment of the posture appears to be the prerequisite for efficient FES assisted and arm supported standing exercise.

Some patients are able to assume such posture by themselves, while many must be aided by additional measures. At present, surface stimulation of knee extensors combined with some "intelligent shoes", delivering information to the stimulator and the standing person, looks to be adequate choice. In future applications implanted stimulation with use of sensory information from the natural sensors is envisaged.